PART IX.

THE ORGANS OF SENSE, &c.

A

SYSTEM

OF

ANATOMICAL PLATES,

ACCOMPANIED WITH DESCRIPTIONS,

AND

PHYSIOLOGICAL, PATHOLOGICAL, AND SURGICAL

OBSERVATIONS.

BY

JOHN LIZARS, F.R.S.E.,

FELLOW OF THE ROYAL COLLEGE OF SURGEONS, CORRESPONDING MEMBER OF THE MEDICAL SOCIETY OF EMULATION OF PARIS, AND LECTURER ON ANATOMY AND SURGERY, EDINBURGH.

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TO

SIR EVERARD HOME, Bart.

VICE-PRESIDENT OF THE ROYAL SOCIETY; SERJEANT-SURGEON TO KING; SURGEON TO THE ROYAL HOSPITAL, CHELSEA; SENIOR SURGEON TO ST. GEORGE'S HOSPITAL; HONORARY PROFESSOR TO THE ROYAL COLLEGE OF SURGEONS, &c.

THIS PART IS INSCRIBED,

AS A MARK OF

ADMIRATION OF THOSE DISTINGUISHED TALENTS,

WHICH HAVE ELUCIDATED

THE DARK PATHS OF

THE PHYSIOLOGICAL AND PATHOLOGICAL SCIENCES,

BY HIS VERY OBEDIENT SERVANT,

THE AUTHOR.

PREFACE.

THE Author cannot allow this Part to go forth to the public, without adverting to the increasing difficulties by which the prosecution of medical studies is prevented. The community, who are sensitively alive to self-preservation on other occasions, seem blind and infatuated in this instance,—they appear to think, that as long as the evil hour is postponed, so long may they oppose the means necessary to avert the evil; nay, their minds remain obdurate till the last scene of sickness and danger presents itself. This very session, the liberal, enlightened, and truly philanthropic Public Authorities of Glasgow and Newcastle have *arrested* in their progress *subjects travelling* through their cities, as if they were Radicals carrying *death* and destruction through the country. Doubtless Baillie Jarvie hopes to signalise himself so much, that a monument equal to that of Sir John Moore, will be erected to his memory on the opposite side of George Square, Glas-

gow; and My *Lord* Mayor of Newcastle, no doubt, expects that his officious zeal will acquire him as much renown as My Lord Chief Justice in Henry the Fourth. There is not a physician or a surgeon, who can do his duty properly to his patient, or conscientiously to himself, who does not occasionally, I ought to say daily, inspect the human frame. The youngest and the oldest of the profession are appointed to hospitals, to take charge of the lives of their fellow-creatures, without having put their hand to a dead body. Let any one read the public medical journals, or investigate the reports of the hospitals, and reconcile to his feelings the fatal blunders which are daily committed both by physicians and surgeons. How many are treated for colick, and die of inflammation of the bowels? how many are treated for low nervous fever or typhus, and die of acute inflammation? how many are tortured on the operating table for stone in the bladder, or for aneurism, and die on the same or the following day, of hemorrhage, or inflammation produced by the unhallowed hands of the surgeon?

> "Enter his chamber, view his breathless corpse,
> "And comment then, upon his sudden death."

And whence do all these lamentable mistakes arise? Solely in consequence of physicians and surgeons having no opportunities of making themselves masters of their profession.

The next question which may naturally be asked, is, Does not the same lamentable evil exist in private practice? and the answer is as naturally, Undoubtedly it does. This very day I have operated on a gentleman from the contiguous county of England to that of the *worthy Mayor* of Newcastle, for fistula in perineo, whose urethra was destroyed by one of the medical practitioners of the county attempting to introduce the catheter about three years ago. I have been obliged to lay the urethra open from the bulb onwards to the bladder, or rather I have been compelled to make a new urethra, for every vestige of the former one was obliterated by sinuses; and I here candidly confess, that all the operations for puncturing the bladder, which I have performed (and these have not been a few), have been in consequence of practitioners injuring the urinary canal by the introduction of the catheter.

Since the publication of Part VI., the Royal College of Surgeons of Edinburgh have passed a law, enacting, that three months' dissection shall in future

be held necessary for qualifying candidates for diplomas; and the Senatus Academicus of our far-famed University, have even yet only recommended a three months' course of dissections for graduation. Since the publication of the above Part, too, the author has presented a Memorial to the Town-Council of Edinburgh, setting forth the evils which are daily accruing both to the medical school and the public, from the want of *subjects;* but his memorial, he regrets to say, has produced no favourable result; for, as the late celebrated Dr. Pitcairn said, when he was using every exertion to establish an anatomical school here, in 1694, "there is great opposition by the chief surgeons, who neither eat hay, nor suffer the oxen to eat it."* *Subjects* have now risen to the enormous sum of twenty guineas,—a sum sufficient to enable a student to go to Paris, study his profession, and return home—and have moreover become so scarce, that one Lecturer on Anatomy, who has been teaching for these four years past, has been obliged to resign; and that able and scientific lecturer, Dr. Barclay,—who has now, from the natural course of years, resigned his duties as a teacher,—has, within these some years back, been repeatedly

* Bower's History of the University of Edinburgh, vol. ii. page 149.

heard to say, that he saw no alternative except giving up teaching human, and confining himself to comparative anatomy.

EDINBURGH, 33 YORK PLACE,
24th December 1825.

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THE MUSCLES

OF

THE HEAD AND NECK.

In dissection, I would recommend it to the student to begin with the muscles of the face, as they spoil much more quickly than those of the neck. The latter, however, I shall describe first, as I intend next to advance to the muscles of the face, and then proceed to those of the organs of sense.

In Part IV. several of the muscles of the back of the neck are described, so that only those on the anterior or sternal aspect of this part require to be detailed. When the integuments are dissected off on the lateral aspect of the neck, a delicate expanse of muscular fibres presents itself, as displayed in Plate X. of Part II., marked F, which is named the platysma myoides.* To display this muscle, an incision should be cautiously made through the skin and cellular substance, parallel with its fibres, from over the centre of the base of the inferior maxilla, to the middle of the clavicle A, and the in-

* Syn. Est alterius lateris primus musculus, eorum qui buccas et labra movent: Musculus latus in collo positus: πλατυσμα μυῶδες: Quinti paris maxillæ: Musculus auriculæ et utrique labro communis: Musculus latus: Detrahens quadratus, communis buccarum labiorumque: Quadratus genæ, seu tetragonus: Quad-

teguments reflected to each side. The muscle will then be observed to be attached nearly to the whole extent of the clavicle A, and to the cellular web enveloping the pectoralis major and deltoid muscles; also to the base of the inferior maxilla and the cellular envelope of the parotid gland s, and that of the masseter muscle l, the anterior or glabellar fibres mingling with those of the depressor anguli oris b. The attachment to the clavicle is considered the origin of this muscle. The function of this muscle is chiefly to corrugate the skin of the neck, with which it is intimately connected, and to assist the cutaneous venous circulation.* It also assists the depressor anguli oris in depressing the angle of the mouth, and in drawing the skin of the cheek downwards; has some effect in depressing the head laterally, and the inferior maxilla downwards, or sternad; likewise in rotating the head on the vertebra dentata; and when the head is fixed, in elevating the skin and even the trunk. In physiognomy,

ratus genæ, vel latissimus colli: Platisma myodes: Le péaucier: Pars ex mala nascens, est risorius novus: Pars ad auriculam pertinens est portio musculi cutanei supra parotidem ad aurem adscendentis: Adducens ad anteriora: Sunt fibræ carneæ a musculo quadrato colli ad partem auriculæ inferiorem dilatæ: The common proceeding from the quadratus genæ: Musculus cutaneus: Le thoraco-facial: Thoraco-maxilli-facial.

* The platysma myoides is concerned in opening the external jugular vein D, in Plate IX. of Part II.; in the securing of the common carotid artery; in the extirpation of diseased lymphatic glands of the neck; in the extirpation of diseased submaxillary gland; and in the various other surgical operations of the neck. The manner of performing the first of these operations is described in page 49, and the second at page 40 of Part II. When the submaxillary or the lymphatic glands in this region are diseased, the platysma myoides so binds them down, that the magnitude of the tumour cannot be ascertained until the operation is begun, on which account the operator is frequently deceived: in all such cases, a free incision through this muscle is requisite, and the operator should dissect from the sterno-cleido-mastoideus muscle, towards the symphisis menti and trachea, keeping the edge of the scalpel to the tumour, and the back to the carotid artery and internal jugular vein.

this muscle assists in the expression of seriousness or gravity, and when violently thrown into action, in performing various grimaces.

A bold elegant muscle, named the sterno-cleido-mastoideus,* marked E, in Plate IX. of Part II., and situated beneath the platysma myoides F, extends obliquely along the side of the neck, derives a tendinous and fleshy origin from the upper or atlantal margin of the sternum, and the sternal third of the clavicle A, and ascends with parallel muscular fibres, to be inserted tendinous in the mastoid process of the temporal bone, and in the ridge extending backwards or iniad, to meet the superior transverse ridge of the occipital bone. The origin of this muscle from the clavicle occasionally occupies more of this bone than the third; and the insertion is sometimes blended with that of the trapezius 80.

The sterno-cleido-mastoideus inflects the head obliquely laterad, and forwards or sternad; when both muscles act, they inflect it directly forwards or sternad; and when this is the fixed point, they assist in approximating the trunk to the head.†

In the mesial line of the neck, beneath the integuments and the platysma-myoides, two slender muscles, having

* Syn. Musculi a pectoris osse et clavicula in caput inserti, pars ex pectoris osse pronata: Pars eadem septimi caput moventis: Eadem septimi paris, eorum qui caput movent: Eadem mastoidei, seu mastoidæi: Eadem ejus, qui le sterno-mastoidien, ou mastoïdien exterieur ou anterieur: Cleido-mastoideus: Sterno-mastoideus: Sterno-cleido-mastoideus: Sterno-cleido-mastoidien: Sterno et cleido-mastoideus: Sterno-clavio-mastoïdien.

† The sterno-cleido-mastoideus is concerned in securing the arteria innominata, (see Part II. p. 38); in securing the common carotid artery, (see Part II. p. 40); in securing the subclavian artery, (see Part II. p. 71); in extirpating the thyroid gland, in the extraction of tumours in the region of the neck, (see Part II. p. 41); and in wry-neck it is proposed to divide this muscle, but as the antagonist muscles are ever ready to take advantage of their opponents, this mode of practice appears very objectionable. Cases, however, are on record, where the

parallel fibres, are situated, which are named the sterno-hyoidei.* They are marked c, c, in Plate IX. of Part II., and Plate I. of Part IX. The sterno-hyoideus derives its origin from the upper or atlantal margin of the first bone of the sternum, from a small portion of the clavicle and first rib in its contiguity, and ascends in conjunction with its fellow to be inserted in the inferior or sacral aspect of the body of the os hyoides x. This muscle depresses the os hyoides to one side; and through the medium of this bone, by keeping it fixed, the sterno-hyoideus contributes to depress the inferior maxillary bone, thus assisting in opening the mouth, and in a similar manner assisting in deglutition. When the inferior maxillary bone and the os hyoides become the fixed points, the sterno-hyoideus aids in elevating the trunk towards the head.†

division of this muscle has cured the disease. Sometimes only a portion of the muscle is rigid, as, for example, the clavicular attachment, and then a division of it might be made by cutting carefully the origin of the fibres from the clavicle, keeping in view the anterior external jugular, and the subclavian veins. If the operator deems it necessary to divide the whole of the muscle, this may be done either at the origin or insertion, with more ease and less danger, however, at the latter than at the former. Should he prefer the origin, he has only to continue the preceding operation, and divide the sternal attachment, keeping close upon the bone. If he prefer the insertion, a transverse division must be made close upon the bone, and if the operator proceed carefully, he will injure no important objects. When this muscle has been divided, the chin or head-stay should be used to prevent a re-union of the muscle to the same extent as formerly. The objects which are liable to be wounded will be best understood by comparing Plates VII. VIII. IX. and X. of Part II. Either of these modes will be found preferable to and safer than that adopted by Sharp or B. Bell. This affection has also been cured by electricity.

* Ossi *υ* referenti propriorum alterius lateris primus: Primus hyoides: Primi paris hyoidis ossis: Primi paris ossi hyoidi, ad linguæ motum destinatorum: Secundi paris ossis hyoidis: Sterno-hyoidæus: Secundi paris, detrahentis, sterno-hyoidei: Sterno-hyoides: Le sterno-hyoïdien, ou sterno-cleido-hyoïdien.

† The sterno-hyoideus is concerned in performing laryngotomy and tracheotomy, in extirpation of the thyroid gland, in securing the common carotid artery

The sterno-thyroidei* B, in Plate VIII. of Part II., and in Plate I. of Part IX., are situated immediately beneath, or centrad to the sterno-hyoidei; they therefore occupy the same region of the neck. This pair of muscles are broader and shorter than the sterno-hyoidei; they derive their origin from the atlantal margin of the first bone of the sternum, and from the first rib, ascend with parallel fleshy fibres, and are inserted into the lower or sacral margin of the thyroid cartilage. The sterno-thyroidei assist in depressing the larynx, and when only one muscle acts, it depresses the larynx laterally. They indirectly depress the inferior maxillary bone, and indirectly aid in deglutition.†

Continuous with the fibres of the sterno-thyroideus, there is a short muscle extending between the thyroid cartilage and the os hyoides, which appears to be a continuation of the sterno-thyroideus, and is named the thyro-hyoideus.‡ It derives its origin from the sacral margin of the thyroid cartilage, where the sterno-thyroideus is inserted, and ascends with parallel fibres to be inserted in the cornu of the os hyoides. The action of this muscle is to approximate the os hyoides and thyroid cartilage in the various motions of the larynx.§

near its commencement, and in securing the arteria innominata, (see Part II., pages 38 and 40.)

* Syn. Communium laryngis musculorum tertius et quartus: Primus communis laryngis: Secundi paris communium laryngis musculorum: Primi paris communium laryngis: Bronchius: Primi paris extendentium thyroidem, vulgo bronchii dicti, at nobis sterno-thyroidei: Sterno-thyroides: Le sterno-thyroïdien.

† The sterno-thyroidei are concerned in tracheotomy, in extirpation of the thyroid gland, in securing the common carotid artery near its commencement, and in securing the arteria innominata, (see Part II. pages 38 and 40.)

‡ Syn. Communium laryngis primus et secundus: Secundus communium laryngis: Hyothyroïdeus: Hyothyroïdes: Hyo-thyroïdien.

§ The thyro-hyoideus is concerned in laryngotomy.

The omo-hyoideus* marked U, in Plate IX. of Part II., and in Plate V. of Part IV., situated in the lateral region of the neck, beneath or centrad of the sterno-cleido-mastoideus E, and parallel for some extent with the sterno-hyoideus C, is a delicate muscle, which derives its origin from the superior costa, and from the proper posterior ligament of the scapula. The slender muscular fibres ascend obliquely forwards, running beneath the trapezius 80, the clavicle A, and the sterno-cleido-mastoideus E, until they advance to the middle of the sterno-hyoideus C, to which they adhere, and ascend on its outer margin, to the body of the os hyoides X, in which they are inserted.† Where the muscle passes beneath the sterno-cleido-mastoideus, it is tendinous from the friction at this part. The muscle is therefore digastric. The function of the omo-hyoideus is chiefly to operate on the larynx, depressing the os hyoides laterally and dorsad when one muscle acts, and directly sacrad when both muscles are in action. This muscle also assists indirectly in deglutition, and in depressing indirectly the inferior maxillary bone. When the os hyoides is a fixed point, this muscle assists in elevating the scapula atlantad and sternad.

The crico-thyroideus‡ is a small arrangement of muscular fibres, represented in Plate VI. of Part II., and

* Syn. Est septimus et octavus propriorum ossis υ referenti: Quartus hyoidis: Quarti paris hyoidis: Quarti paris, ossi hyoidi, ad linguæ motum destinatorum: Quarti paris ossis hyoidis: Coraco-hyoideus: Paris quarti, oblique deorsum trahentis, coraco-hyoidei appellati: Coraco-hyoides: Coraco, seu costo-hyoides: L'omoplat-hyoïdien, communément coraco-hyoïdien: Omo-hyoïdien: Scapulo-hyoïdien.

† The omo-hyoideus is concerned in securing the carotid artery, (see Part II. p. 40), and in securing the subclavian artery, (see Part II. p. 71.)

‡ Syn. Quartus propriorum laryngis: Primus musculorum propriorum laryngis: Ex propriis laryngis musculus anterior exteriorque: Crico-thryoïdeus anticus: Crico-thyroïdes: Crico-thyreoïdeus: Dilatateur antérieur.

in Plate I. of Part IX., marked a, situated beneath the sterno-thyroideus, and, as its name indicates, extends between the cricoid and thyroid cartilages. The fibres derive their origin from the base of the cricoid cartilage, and run obliquely backwards, to be inserted in the sacral margin of the thyroid cartilage. The two muscles nearly meet anteriorly at their origin, and separate wider and wider in their progress backwards, towards the thyroid cartilage, leaving a triangular space where laryngotomy is performed.* This pair of muscles operate on these cartilages of the larynx, approximating the one to the other in the various motions of this organ.

I shall now proceed to the description of those muscles which extend between the inferior maxilla and the os hyoides.

Immediately beneath the integuments between the inferior maxilla and the os hyoides, two muscles are seen nearly uniting with each other; these are the anterior bellies of the digastric† muscles, and are marked *w*, in Plate IX. of Part II., and in Plate I. of Part IX. Each anterior belly, or head *w*, is attached to the base of the inferior maxilla 25, where it unites with the opposite muscle, and is considered its insertion. From this point, the muscular fibres converging descend obliquely backwards, to the side of the body of the os hyoides, where they become tendinous, and adhere to that bone, or are bound to it by ligament; whence the fibres again ascend obliquely upwards and backwards, run generally

* The crico-thyroidei are concerned in performing laryngotomy.

† Syn. Alterius lateris maxillam moventium quartus: Maxillæ inferioris quartus os aperiens: Quarti maxillæ paris: Alterius paris maxillæ deprimentis biventris: Paris digastrici, sive biventris: Digastricus seu biventer: Biventer maxillæ: Mastoido-génien: Mastoïdo-hygénien.

through the delicate muscular fibres of the stylo-hyoideus G, soon become fleshy, W, and proceed in their course to the rut in the temporal bone, where they are attached, (see Part I. Plate V. *Fig.* 7, letter *b*,) and covered by the sterno-cleido-mastoideus E.* This latter part of attachment is considered its origin, and from this to the os hyoides is named the posterior head, or belly. Sometimes fleshy fibres arise from the os hyoides and join the anterior tendinous ones. The digastric muscle depresses the inferior maxilla, and raises the larynx and pharynx in the action of deglutition.

The mylo-hyoideus† muscle *m*, in Plates VIII. and IX. of Part II., and in Plate I. of Part IX., situated beneath or centrad of the anterior belly *w* of the digastric muscle, may be considered as one muscle, as adopted by Chaussier, instead of a pair of muscles, as it is a broad fan-like arrangement of muscular fibres, descending from the inferior maxilla to the os hyoides. As a pair, each is described as deriving its origin from a ridge on the interior or central surface of the inferior maxilla, (see Part I. Plate VI. *Fig.* 26, letter *p*,) between the last dens molaris and the symphysis menti; the muscular fibres descend forwards in a converging manner, unite with those of the opposite side, and are inserted into the convex portion of the body of the os hyoides X.‡ The function of the mylo-

* The digastric muscle may become concerned in the extirpation of diseased lymphatic glands at the angle of the inferior maxilla. The operator should remember, that the branches of the external carotid artery, with the exception of the greater portion of the facial, are beneath or centrad to this muscle.

† Syn. Secundi paris ossi υ referenti propriorum: Secundi paris hyoidis ossis: Secundi paris ossi hyoidi, ad linguæ motum destinatorum: Primi paris ossis hyoidis: Milo-hyoideus: Primi paris, recta attollentis, genio-hyoidei: Milo-hyoides: Le mylo-hyoïdien.

‡ The mylo-hyoideus muscle relates only to that masterly operation, the removal of the inferior maxillary bone, (see page 125 of Part I.)

hyoideus is to elevate the os hyoides in the action of deglutition, and to depress the inferior maxilla in opening the mouth.

When the mylo-hyoideus is carefully detached at its origin from the inferior maxillary bone, and reflected downwards to its insertion, a pair of short muscles are brought into view, the genio-hyoidei,* marked *l*, in Plate VII. of Part II., and in Plate II. of Part IX. They are so close together, that it requires some pains to separate them. They arise tendinous from a small ridge on the internal or central surface of the inferior maxillary bone, forming part of the symphysis menti, (see Part I. Plate VI. *Fig.* 26, ridge between *n* and *m*; Description, page 61), and descend to be inserted fleshy into the centre of the body of the os hyoides. The genio-hyoidei depress the inferior maxilla, so as to open the mouth, and elevate the larynx and pharynx in deglutition.†

When the genio-hyoidei are neatly insulated, and divided across, there appear a pair of muscles precisely similar, but which, on more minute inspection in the lateral aspect, are observed to radiate towards the tongue, and are therefore named genio-hyo-glossi.‡ They are marked with the letters *k*, in Plate VII. of Part II., and in Plates II. and III., *Figs.* 1, of Part IX. They derive their origin from two small elevations on the internal or central surface of the inferior maxillary bone, on each side of the

* Syn. Quinti paris hyoidis ossis: Quinti paris ossi hyoidi, ad linguæ motum destinatorum: Le genio-hyoïdien.

† The genio-hyoideus is concerned in removal of the inferior maxillary bone, (see Part I. p. 125.)

‡ Syn. Nonus linguæ: Quartus linguæ: Quintus linguæ: Primum par linguæ: Genio-glossus.

symphysis menti, (see Part I. Plate VI. *Fig.* 26, letters *n*, *n*,) descend in a radiating form, to be inserted in the base of the os hyoides, and the tip, middle, and root of the tongue; the latter bundle of fibres intermingling with those of the stylo-glossus and lingualis muscles. The function of this muscle, from the radiation of its fibres, is very varied and extensive; it pushes the tongue to the palate, and out of the mouth, retracts it, moves it from side to side, draws the tip downwards in the mouth, and renders its dorsum convex or concave. The fibres extending to the os hyoides depress the inferior maxilla, or elevate the larynx and pharynx in deglutition.*

Before proceeding with the other muscles of the tongue, the three styloid muscles should be examined; indeed, it would have been preferable to display the stylo-hyoideus immediately after the digastric, as it obstructs, in some degree, the student in examining the mylo-hyoideus. The stylo-hyoideus† muscle G, in Plate I. of Part IX., accompanies the posterior head W of the digastric muscle, by which it is often perforated, and, as its name indicates, it extends between the styloid process and the os hyoides. It derives a tendinous and fleshy origin from the middle and inferior part of the styloid process of the temporal bone, soon becomes fleshy, and descends to be inserted in the side of the os hyoides. The precise origin of this muscle is better seen in Plate II. of Part IX. Near its insertion it is generally pierced with the posterior head W of the digastric muscle. The function of the stylo-hyoideus

* The genio-hyo-glossus is concerned in extirpation of the tongue, and in removal of the inferior maxillary bone.

† Syn. Tertii paris ossi υ referenti propriorum: Stylo-ceratoïdes: Stylo-ceratohyoideus: Stylo-hyoïdes major.

is to elevate the os hyoides, and through it the larynx and pharynx, in deglutition.*

A small slender slip is sometimes found descending to the cornu of the os hyoides, which, when present, is named stylo-hyoideus alter.

A delicate ligamentous slip *s*, generally extends from the styloid process *q*, of the temporal bone, to the angle *d*, of the inferior maxillary bone, as represented in Plate I. of Part IX. This ligamentous slip commonly arises in conjunction with the stylo-hyoideus G, from the styloid process. Another ligamentous slip, still more delicate, frequently extends from the styloid process, to the cornu of the os hyoides.

When the posterior belly of the digastric muscle, and the stylo-hyoideus, are removed, the other two styloid muscles are brought into view, viz. the stylo-glossus m, and the stylo-pharyngeus k, both of which are delineated in Plate VIII. of Part II., and in Plate II. of Part IX. The stylo-glossus muscle† m, the situation of which is indicated by its name, derives a tendinous and fleshy origin from the styloid process *q*, and the ligamentous slip *s*, extending to the inferior maxillary bone, and descends obliquely forwards to the root of the tongue, where its fleshy fibres spread, extending onwards along the side nearly to the apex or tip, blending or intermingling with the fibres of the lingualis and the genio-hyo-glossus muscles. The function of the stylo-glossus muscle is to pull the tongue upwards, laterally, and backwards, or coronad, laterad,

* In operating at the angle of the jaw-bone, the surgeon should be aware that the stylo-hyoideus muscle lies superficially to the branches of the external carotid artery, with the exception of the continuation of the facial branch.

† Syn. Quintus et sextus linguæ musculorum: Tertii paris linguæ musculorum: Tertii paris propriorum linguæ: Secundi paris linguæ: Sexti paris, oblique trahentis, stylo-glossi.

and iniad; by this means approximating the root of the tongue to the fauces, so as to diminish the isthmus faucium, and therefore concerned in deglutition. By pulling the root of the tongue upwards and backwards, it overhangs the glottis, and prevents the bolus of food getting into the larynx. When one muscle acts, it moves the tongue dextrad or sinistrad. They must also have the power of pushing the tongue upwards and forwards towards the roof of the mouth, as is exemplified in other muscles of the tongue, viz. the genio-hyo-glossi; and must, therefore, be concerned in speech.*

The situation of the stylo-pharyngeus† k, is indicated by its name. This muscle derives a fleshy origin from the styloid process of the temporal bone, and descends obliquely downwards; its fibres blend with those of the inferior constrictor of the pharynx, and some are capable of being traced downwards to the thyroid cartilage. The function of this muscle is to dilate or compress the pharynx, and to elevate both it and the larynx, upwards and backwards in deglutition.

When these styloid muscles have been removed, the deeper seated muscles of the tongue may be examined. The hyo-glossus‡ muscle, marked *i*, in Plates VII. and VIII. of Part II., and in Plate I. of Part IX., derives its fleshy origin from the cornu of the os hyoides x, and ascends with a broad arrangement of parallel fibres, to the side of the root of the tongue, where they intermingle with those

* The stylo-glossus is only concerned in extirpation of the tongue, when cancerous.

† Syn. Quarti paris linguæ, quod et faucibus adscribi potest: Tertii paris faucium, stylo-pharyngei: Stylo-pharyngæus.

‡ Syn. Pars tertii et quarti linguæ musculorum: Secundum par linguæ: Tertium par linguæ musculorum: Basio-glossus: Quintum par deprimens, sive cerato-glossus: Cerato-glossus, Basio-glossus et Chondro-glossus: Hio-glossus: Hyoglossi: Hio-chondro-glossi.

of the genio-hyo-glossus, the stylo-glossus, and the lingualis muscles. The function of this muscle is to elevate or depress the root of the tongue, and also to expand its breadth, wherefore it is concerned in speech and deglutition.

The lingualis muscle,* marked 60, in Plate VII. of Part II., is partly obscured by the insertions of the hyo-glossus *i*, and the genio-hyo-glossus *k* muscles, between which some of the fibres of the lingualis are seen. It arises by scattered fibres from the side of the root of the tongue, advances onwards more or less blended with the fibres of the stylo-glossus muscle, and is lost in scattered fibres at the apex or tip of the tongue. The function of this muscle is to direct the tongue upwards, downwards, laterally, forwards, and backwards; hence it is employed in speech and deglutition.

Besides the fibres of the lingualis, there are a number of muscular fibres distributed throughout the tongue, as will be represented in sections of that organ. These are arranged longitudinally,† transversely,‡ and perpendicularly,§ and multiply the motions of the tongue to a great extent. In their individual strata they contract or relax that portion of the tongue wherein they are situated.

In a regular order of dissection, the muscles of the pharynx should follow those of the tongue. There are three constrictor muscles described by the majority of authors, but these are in reality but one. They are delineated in Plates I. and II. of Part IX., the inferior being marked Y, the middle F, and the superior *y*. The inferior is only separated from the medius, and the medius from

* Syn. Les fibres longitudinales.

† Syn. Fibræ longitudinales.

‡ Syn. Fibræ transversales.

§ Syn. Fibræ perpendiculares.

the superior, at their origins, all of them being blended in their course and insertions. The constrictor pharyngis inferior Y,* derives a fleshy origin from the sides of the cricoid and thyroid cartilages; the inferior fibres proceed directly across, and the superior obliquely upwards around the mucous bag of the pharynx, where they unite with the muscular fibres of the opposite side, forming a delicate white line.† The constrictor pharyngis medius‡ F, derives a fleshy origin from the cornu of the os hyoides X, and from the root of the tongue, and the fibres proceed obliquely upwards, uniting, as they advance, with those of the opposite side, to be inserted into the cuneiform process of the occipital bone, anterior or glabellad

* Syn. Thyro-pharyngeus et crico-pharyngeus: Pars œsophagæi seu sphincteris gulæ: Thyro et crico-pharyngien: Le constricteur inférieur du pharynx: Portion du stylo-pharyngien: Crico-thyro-pharyngien.

† Where the inferior constrictor Y surrounds the œsophagus, or joins the œsophagus I, there is a diminution of the calibre or a constriction of the continued tube of the pharynx and œsophagus, which is best understood by inserting the finger from the pharynx into the œsophagus. This constriction is the point where foreign bodies, as cartilage, when swallowed, are arrested in their progress to the stomach. In such an event, the probang of every contrivance should be first employed, but if ineffectual, an incision ought to be made on that side of the neck where the body projects most, (if one side is not more prominent than another, the right should be preferred), parallel with the tracheal margin of the sterno-cleido-mastoideus, through the integuments and platysma myoides muscle, avoiding the external and the internal jugular veins, the common carotid artery, and the nervus vagus. The knife should be lateralized with the edge towards the trachea. These important objects should be held aside to the dorsal aspect, when the prominent object will appear, which should then be liberated by an incision through the constrictor muscle and mucous membrane of the pharynx. The external wound is to be brought together by adhesive plaster, and a bandage or handkerchief slightly applied. The patient to be kept extremely quiet, on low diet, nothing but milk or water for some days, which should be introduced into the stomach by an elastic tube.

‡ Syn. Hyo-pharyngeus: Pars œsophagæi seu sphyncteris gulæ: Hyo-pharyngien: Le constricteur moyen du pharynx: Portion du stylo-pharyngien: Hyo-glosso-basi-pharyngien.

to the foramen magnum. The constrictor pharyngis superior* *y*, arises from the inferior and superior maxillary bones, near the dentes sapientiæ; between these from the root of the tongue, the palate, and the buccinator muscle; from the pterygoid muscles, particularly the internal; and from the cuneiform process of the occipital bone, near the anterior condyloid foramina. The fibres proceed almost directly across, to unite with those of the opposite side. The points of origin of the superior constrictor are more delicate than those of either the medius or inferior, the superior is overlapped by the medius, while the medius in its turn is overlapped by the inferior constrictor; and the three muscles constitute the chief strength of the bag of the pharynx. This pouch, as delineated in Plates I. II. III. IV. and V. *Figs.* 1, is a muscular and mucous membranous sac, extending from the basis of the skull, or the cuneiform process of the occipital bone, to the œsophagus I, or to the sacral margin of the cricoid cartilage N; and bounded posteriorly or dorsad by the cervical vertebræ, and anteriorly or glabellad by the posterior apertures of the nares T, T, Plates III. IV. and V. *Figs.* 1, the velum pendulum palati F, Plates III. IV. and V. *Figs.* 1, the arches of the fauces 1, 2, the root of the tongue G, the epiglottis Q, Plates III. IV. and V., and the arytenoid, the thyroid, and cricoid cartilages.

The pharynx is widest behind the nares, which portion is named the arch; it then contracts a little on each side, and again expands behind the epiglottis, which latter por-

* Syn. Milo-pharyngæus, glosso-pharyngæus, pterygo-pharyngæus: Mylo-glosse glosso-pharyngien, pterygo-pharyngien, génio-pharyngien: Pars œsophagæi seu sphincteris gulæ: Le constricteur supérieur du pharynx: Portion du stylo-pharyngien: Ptérigo-syndesmo-staphili-pharyngien.

tion is termed the body; and lastly it contracts, where it terminates in or becomes the œsophagus, which portion is styled the sphincter. At the arch, or immediately behind the posterior apertures of the nares, the Eustachian tubes terminate, as delineated in *Fig.* 2 of Plate V. letter z; and in this neighbourhood there are several longitudinal rugæ. There are also rugæ behind the larynx.

Besides the mucous and muscular structures, the muscular is surrounded by a cellular expanse, which is troublesome to dissect off, in order to display the former.

I shall here continue the description of the pharynx, although it would probably be more systematic to describe it along with the organs of mastication, deglutition, and digestion. In Plate II., and *Fig.* 1 of Plate V., the pharynx is seen lined with a soft mucous membrane, marked b, resembling velvet, which is a continuation of that of the nares and mouth; and in Plates III. and IV., this membrane is observed to be studded with a multiplicity of small glands of the conglobate kind, named pharyngeal. These glands secrete the greater portion of the mucous fluid, which lubricates this surface in deglutition and respiration. The termination of the capillary arteries here is into secreting points, which contribute also to supply the mucous fluid.

After the investigation of the pharynx and its muscles, the dissector should proceed to the muscles of the soft palate; but the muscles attached to the inferior maxillary bone require to be previously examined, and, as formerly mentioned, those of the face should precede the latter. Keeping this natural order in view, I shall proceed to the muscles of the velum pendulum palati, previously describing the velum itself. This curtain,* marked F, in *Figs.* 1

* Syn. Valvula palati.

of Plates III. IV. and V. of Part IX., consisting of a number of muscles and glands, invested with a mucous membrane, hangs elegantly down in the back part of the mouth, from the posterior or inial free margin of the palate bones (see Part I. Plate IV. *Fig.* 2, digits 22), and terminates in a central pendulous point, named the uvula, or pap of the throat, which is marked *f*, and which forms the central apex, or junction, of four arches,* marked with the digits 1, 2, or what is named in architecture, the central point of a groined arch; their lower extremities resting on, or arising from the root of the tongue, and the sides of the body of the pharynx. The digits 1 indicate the two anterior, which arise from the root of the tongue; and the digits 2 the posterior arches of the fauces, which arise from the sides of the body of the pharynx. The space bounded by these arches and the uvula is named the fauces. The glandular object, situated on each side between two of these arches, marked 3, is termed the tonsil, amygdala, or almond. This glandular tissue has a number of lacunæ opening towards the fauces, as represented in *Fig.* 1 of Plate V., is of a reddish colour, and has some resemblance to the exterior of the shell of the almond, and is classed under the conglobate glands. The mucous glands of the velum are distinctly represented in *Fig.* 1 of Plate IV. Both these and the amygdalæ secrete mucus, to lubricate these surfaces in deglutition and speech.†

* Syn. Columnæ septi palati.

† The amygdalæ, or tonsils, are subject to inflammation, which, when it assumes the phlegmonous type, constitutes cynanche tonsillaris, being circumscribed, of a deep-red or purple colour, and greatly swollen. The tumefaction is sometimes so great, that when both tonsils are inflamed, they approximate and prevent deglutition, chiefly, however, by impeding the action of the muscles. The treatment is

The muscles operating on the velum palati, are the constrictor isthmi faucium, the palato-pharyngeus, circum-

by the application of the vapour of water through the medium of a tube, or what is termed a *douche*, to the tonsils; leeches to the neck, poultices around the exterior of the throat; and if the inflammation be severe, the external jugular, or one of the veins of the arm should be opened, for the practitioner should be apprehensive of the inflammatory action, even although phlegmonous, spreading downwards, along the velum to the pharynx and larynx. Brisk cathartics should be given, the feet immersed in hot water twice or thrice a-day, and low diet with rest enjoined. Blisters are often found very efficacious after leeches and the lancet; and whenever suppuration appears established, the tonsil should be lanced carrying the instrument from the side of the throat to the mesial line.

The tonsils and velum are equally subject to erysipelatous inflammation, in which case there is little or no tumefaction, but only a rose-coloured inflammation, with one or more whitish-coloured ulcers, resembling aphthæ more than ulceration. The ulceration, however, is generally deep and extensive, occurring in patches. This affection is much more liable to spread downwards to the larynx, than the former, or phlegmonous, and is then indicated by acute pain in swallowing, with a sort of convulsive action. The patient seems horrified when the saliva or any thing induces him to swallow. I have known patients fall victims to this affection, before the practitioner appeared in the least degree aware of the danger; and on dissection, I have found the cellular substance around and between the sterno-hyoideus, sterno-thyroideus, and other muscles in contiguity, infiltrated with purulent matter; also the glottis, the epiglottis, the tonsils, and the velum. The treatment requires to be much more active than in the preceding, particularly in the use of the lancet. This erysipelatous affection is what occurs in scarlatina, and is then named cynanche maligna. The inflammation sometimes ends in mortification. Cynanche pharyngæa is characterised by nearly the same symptoms, requires the same treatment, and is seldom an idiopathic affection, but supervenes one of the preceding. The tonsils are very subject to be attacked with ulceration in secondary syphilis. They are also occasionally attacked with a chronic inflammation, which tumefies them to so considerable a magnitude, as to impair the voice and deglutition; and it has been proposed to remove them by ligature, cautery, or the knife. The ligature, from the irritation it produces, is inadmissible; the cautery may be occasionally employed to advantage; but the knife is the best remedy. The mouth of the patient is to be held open by a piece of wood placed between the teeth, and the tongue kept down by a spatula, when the operator transfixes the enlarged tonsil from behind forwards with a curved needle, armed with a large flat ligature, and mounted on a

flexus or tensor palati, and the levator palati, of each side, with the azygos uvulæ in the centre.

The constrictor isthmi faucium,* marked with the digit 1, in *Fig.* 1 of Plate IV., is situated at the back part of the mouth, forming the chief portion of the anterior arch of the fauces, deriving its origin from the side of the root of the tongue, and ascending with delicate fibres, which are lost in the velum palati, near the uvula. This delicate muscle is covered by the mucous membrane of the mouth and velum, and its carneous fibres are distinctly seen through this membrane, indeed fully more distinctly than when removed. The use of this muscle is to contract the fauces in deglutition, by bringing the velum to the tongue, and elevating the tongue to the former.†

The circumflexus palati,‡ marked a, in *Fig.* 1 of Plates III. and IV., situated at the posterior aperture of the nares, and base of the cranium, extending along the mesial aspect of the internal pterygoid muscle, arises by delicate scattered fibres from the spinous process of the sphenoid bone, and around the cartilaginous portion of the Eustachian tube, descends obliquely outwards, along the

stick; with this ligature he is enabled to pull forwards the tonsil with his left hand, and to dissect out the tonsil, by first making a circular incision near its root through the mucous membrane, and then gradually cutting from above downwards, until the mass is extirpated. Gargles of the diluted mineral acids, or of a solution of sulphate of zinc, should be used to suppress any bleeding if troublesome; but if alarming, a piece of dry sponge, having a ligature through it, should be held on the part with the fingers, or the actual cautery applied.

* Syn. Glosso-staphylinus: Glosso-staphylinus seu glosso-palatinus.

† This muscle is concerned in the operation of staphyloraphy, or velu-synthesis.

‡ Syn. Primum par musculorum qui faucibus dilatandis aut constringendis inserviunt: Pterystaphilinus externus: Pterygo-staphilinus externus: Pterigo-palatinus, seu spheno-pterigo-palatinus, seu pterigo-staphylinus: Palato salpingæus: Pterigo-palatinus: Spheno-salpingo-staphylin: Le péristaphylin externe ou inférieur: Pterygo-staphylin.

mesial aspect of the internal pterygoid muscle n, and runs round the unciform process *l* of the sphenoid bone, in the form of an elegant round tendon, which expands in a broad tendinous web, forming the chief strength of the velum palati; the tendon of the one muscle uniting with that of the other, and with some of the other muscles of the velum, as the palato-pharyngeus. The function of this muscle is to stretch the velum, and to elevate it towards the posterior apertures of the nares, so as to prevent solids or fluids ascending in the act of deglutition.*

The levator palati† muscle, marked L, in *Figs.* 1 of Plates III. and IV., situated at the back part, or inial aspect of the velum palati, immediately below or sacrad to the circumflexus palati, is a much bolder muscle than the circumflexus, and separated from it by a small quantity of soft adipose substance; it derives its origin from the exterior of the osseous and cartilaginous portions of the Eustachian tube, and descends obliquely forwards to the velum, where its fleshy fibres spread so as to unite with those of the opposite side, and some of the other muscles implanted in the velum. The function of this muscle is to elevate the velum upwards and backwards, so as to shut up the posterior apertures of the nares in deglutition.‡

* The circumflexus palati muscle is concerned in velu-synthesis, or staphyloraphy.

† Syn. Secundum par musculorum, qui faucibus dilatandis aut constringendis inserviunt: Pterystaphylinus internus: Par internum gargareonis: Pterygo-staphylinus internus: Sphæno-palatinus: Salpingo-staphylinus: Columellæ musculus, in triangularem expansionem deorsum productus, seu spheno-palatinus: Levator palati mollis: Petro-salpingo-staphylin, ou salpingo-staphylin interne: Petro-staphylin.

‡ The levator palati muscle is concerned in staphyloraphy, or velu-synthesis.

In the centre of the uvula, a small round muscle, named azygos uvulæ* is situated, and which is displayed by making a perpendicular incision from the longitudinal palatine suture to the apex of the uvula, either on the anterior or posterior aspect of the velum. This muscle, marked *u*, in *Fig.* 1 of Plate IV., derives its origin from the small projecting point formed by the junction of the palatine plates of the palate bones, and descends perpendicularly along the velum and uvula to the apex or tip of the latter. This muscle assists the circumflexus and levator in elevating the velum and uvula, so as to shut up the posterior apertures of the nares in deglutition.†

The palato-pharyngeus muscle,‡ marked D, in *Fig.* 1 of Plate III., situated in the side of the palate and pharynx, requires to have the fibres of the superior constrictor of the pharynx *y* removed, in order to bring it into view, and is then observed to consist of muscular fibres, extending between the velum palati and the pharynx, which neither arise nor terminate at any definite point. It forms the posterior arch of the fauces. The origin of this muscle is blended with the tendinous expanse of the circumflexus palati, and the fibres in their descent mingle with those of the stylo-pharyngeus k, some of them being ultimately inserted in the thyroid cartilage. The function of the palato-pharyngeus is to contract the aperture of the fauces, so as to propel the bolus of food back-

* Columellæ musculus teres, seu azygos uvulæ: Palato-staphylinus: Staphylins ou êpistaphylins moyens: Releveur de la luette.

† The azygos uvulæ muscle is concerned in velu-synthesis, or staphyloraphy.

‡ Syn. Pharyngo-staphylinus: Staphylino-pharyngæus: Thyreo-staphylinus: Pars œsophagæi: Pharyngo-staphylin; thyro-staphylin; peristaphyli-pharyngien: Le pharyngo-staphylin ou palato-pharyngien: Portion du stylo-pharyngien.

wards and downwards in deglutition; in doing which it assists in elevating the pharynx and larynx.*

* The palato-pharyngeus muscle is concerned in velu-synthesis, or staphyloraphy. This operation, which was first performed on my friend, Dr. Stephenson, Professor of Surgery, Montreal, Canada, consists in rendering raw the edges of the cleft velum palati, and approximating them by means of the interrupted suture. It is performed on those born with the malformation of the velum, consisting of two symmetrical halves, being as it were separated into two, by a perpendicular incision from the posterior or inial point of the longitudinal palatine suture, through the centre of the uvula. Sometimes the one half of the uvula is a little larger than the other. The way to perform this operation, is to seat the patient on a chair opposite a good light, to pass a ligature of three or four threads through the one tip of the uvula, by means of one of the smallest curved needles, a little more curved than they usually are, and mounted on a piece of wood, of the thickness of a common quill, and about six inches long. This needle is more easily passed from behind forwards than the reverse, and should be done the moment the patient opens his mouth, otherwise such retraction of the velum takes place in consequence of the action of the circumflexus and levator palati, that the operator is foiled for a time. This muscular retraction, which seems quite involuntary, occurs very frequently, so as to protract this little operation. The other end of the same ligature, which should be about three feet long, is to be passed by another mounted curved needle, through the other tip of the uvula, and this ligature should be equally portioned, so as that a noose commanding each half of the velum may be held out of the mouth, to facilitate the future steps of the operation. The operator should now lay hold of the one-half of the ligature that commands the one side of the velum with the left hand, and stretch it gently; then with the right hand, having Wenzell's or Ware's eye-knife, pare the margin of the velum from the point where it is attached to the palate bones down to the uvula, a step of the operation which is excessively difficult and troublesome, from the involuntary actions of the patient to swallow, vomit, and cough. If the operator does not succeed in rendering the margin sufficiently raw by means of the knife, he must use the curved eye-scissors. The same is now to be done on the other side, and when the operator is satisfied that the edges are sufficiently raw to ensure adhesion, he brings the halves of the uvula together by means of the long ligature, which he ties, but does not yet cut off the loose ends, for by means of them he is so enabled to keep the velum on stretch, as to pass the other needles and ligatures with much more facility. Other two ligatures are required, and may generally be passed, by transfixing the velum with one needle on the one side from before backwards, or glabello-iniad, and on the opposite side from behind forwards, or inio-glabellad, which saves pain and time. These ligatures being tied, and the operator satis-

These little muscles perform various other functions, which will be better understood when we come to deglutition and speech.

Before proceeding to the examination of the muscles of the larynx, it is necessary to describe the objects which it forms.

The larynx is an assemblage of cartilages at the top or beginning of the trachea, opening into the pharynx immediately posterior or iniad to the root of the tongue, and is the commencement of the windpipe; it is held in this situation by several ligaments and muscles, which have been already described, and is lined with a continuation of the same mucous membrane which invested the pharynx. Five cartilages enter into its formation, of which the thyroid and cricoid are the largest, and constitute chiefly the parietes.

The thyroid cartilage, marked S, in Plates VII. and VIII. of Part II., and in Plate III. *Fig.* 1, and Plate IV. *Figs.* 1 and 2, of Part IX., situated on the anterior aspect of the neck, about the superior or atlantal third, is of an angular shape, the angle pointing forwards, or glabello-sternad; and the two flat sides, named alæ, pointing laterad, and terminating in long free edges, which

fied that every point is in contact, he may cut off the loose ends of the ligatures, see his patient to bed, and enjoin absolute quiescence in eating, drinking, speaking, or even swallowing the saliva; for upon this depends the chance of success, and hence it is in vain to attempt this operation under maturity. On the third day after the operation, the stitches should be withdrawn, and the starvation enjoined for two days longer. During the evening of the day of the operation, and the succeeding five days, the patient must be nourished solely with injections made of beef-tea, milk, and gruel. I performed this operation on a young gentleman about eighteen years of age last summer, and succeeded in uniting the edges, with the exception of about a quarter of an inch of the top near the hard palate. This want of union or aperture, however, is now nearly closed, a circumstance which generally occurs after this operation.

look backwards, or dorsad, and end in oblong points named cornua. When insulated, it has some resemblance to the old-fashioned cocked hat. Its superior or atlantal margin is arched on each ala, having a depression, or notch, between the alæ, representing a cordiform appearance, and is terminated at the free posterior edge of each ala, by a small elongated point, which is named the superior cornu, to distinguish it from another cornu at the inferior margin, which is shorter than the preceding. The two superior are marked *s*, *s*, in *Figs*. 1 and 2 of Plate IV., and the two inferior cornua s, s. The posterior free edge, extending between these cornua, is smooth, and nearly straight, as exemplified in these figures. The inferior or sacral margin is slightly concave at each ala. On the convex or lateral aspect of each ala, an irregular oblique ridge extends between the superior and inferior edges, made by the attachments of the crico-thyroideus, the thyro-hyoideus, and constrictor pharyngis inferior muscles. The superior margin of the thyroid cartilage is connected to the os hyoides x, by a membranous expanse extending between them, marked *r*, in *Fig*. 2 of Plate IV., which at *e* is round, stronger, and somewhat ligamentous, and proceeds from the superior cornu *s*, to the cornu *x*, of the os hyoides. This round ligament has generally a small cartilaginous body, either near the superior cornu of the thyroid cartilage, or near the cornu of the os hyoides. This ligament is also stronger and flatter, where it extends between the notch of the thyroid cartilage and the body of the os hyoides. Stronger and shorter ligaments extend between the inferior cornua s, s, to the cricoid cartilage N, and also from the latter to the former; and a strong membranous expanse proceeds from the inferior margin of the thyroid cartilage to the cricoid cartilage, particularly in the centre or me-

sial aspect. Besides these attachments, the thyroid cartilage is connected to the arytenoid cartilages *c*, *c*, by the vocal ligaments *a*, *a*. The thyroid cartilage becomes ossified in advanced life.

The cricoid cartilage, marked N, in Plate VII. of Part II., and in *Fig.* 1 of Plate III., and in *Figs.* 1 and 2 of Plate IV. of Part IX., situated immediately beneath or sacrad to the thyroid cartilage, and atlantad to the first ring of the trachea K, is of a circular or annular shape, as its name indicates, and is much broader posteriorly than anteriorly. The anterior aspect is thick, convex, and narrow; and on each side extending obliquely upwards, there is a conspicuous tubercle, which affords rest and attachment to the inferior cornu of the thyroid cartilage. The posterior aspect, which is very deep, has a distinct line, marked N, in *Fig.* 2 of Plate IV., extending perpendicularly, with a slightly flattened or concave surface on each side. The lower or sacral margin, which rests on the first cartilaginous ring of the trachea, is arched like the sacral margin of the thyroid cartilage, and is connected by a circular ligament. The upper or atlantal margin is very oblique and slightly arched, and immediately superior to each slightly flattened surface, is a gently convex smooth articular surface, for the articulation of the arytenoid cartilage *c*.*

* In Plate VII. of Part II. there is an oblong square space between the thyroid and cricoid cartilages, which is filled up with a thick and strong ligamentous membrane, in which space laryngotomy is performed. This point can be easily ascertained in the living state, from the projection of the anterior angle of the thyroid, and the firm rotundity of the cricoid cartilages. A longitudinal incision should be made in the mesial line of the neck over this part, through the skin and cellular substance, so as to bring into view the contiguous margins of the cartilages, when the operator should then plunge a semicircularly-shaped trocar and canula at this ligamento-membranous space, obliquely downwards into the trachea. This instrument also answers in tracheotomy, and when we consider that by this means we

The arytenoid cartilages *c*, *c*, in *Figs.* 1 and 2 of Plate IV., and in *Fig.* 1 of Plate V., are two small pyramidal, or triangular cartilages, situated with their bases on the upper margin of the cricoid cartilage, and having their apex pointing upwards or atlantad. Their posterior or sacral surfaces are concave; their anterior convex; their external or lateral, oblique and convex; and their inner or mesial surfaces are nearly straight, being only a little concave. Their apices are sometimes so loose as to ap-

prevent blood getting into the trachea, it is the best instrument. Whenever the instrument is inserted, the trocar is instantly withdrawn. Laryngotomy, sometimes named tracheotomy, is performed in suspended animation from drowning, in order to employ the bellows; also in cases of foreign bodies getting into the larynx or trachea; and in cases of foreign bodies entering the œsophagus, threatening instant suffocation, and incapable of being dislodged by the probang.

Tracheotomy, which is an opening made into the trachea, is not so simple an operation as the preceding. A longitudinal incision is made in the mesial line of the trachea, through the skin and cellular substance, when the operator should feel if there be any artery pulsating, as the arteria innominata, and even the right carotid artery, may come in the way of the knife. He must then proceed, cautiously avoiding the isthmus of the thyroid gland, and plunge the same shaped trocar and canula through the rings of the trachea, withdrawing the trocar as soon as the instrument is introduced. This latter operation has been performed in cynanche laryngea and cynanche trachealis, and also for the same diseases as those for which laryngotomy has. Whenever laryngotomy promises to answer, it ought to be preferred. Tracheotomy ought to be performed in cynanche laryngea and trachealis, whenever the practitioner conceives that the inflammatory action has terminated in the suppurative. To perform it sooner, only aggravates the evil, by increasing the inflammatory action, of which I have witnessed not a few instances. I have lately seen three cases of cynanche laryngea occurring in adults, where, besides effusion of matter round and in the glottis, the muscles on the anterior part of the neck, as, for example, the sterno-hyoidei, sterno-thyroidei, omo-hyoidei, and crico-thyroidei, were infiltrated with pus. The symptoms during life were very insidious, two of them appearing as cynanche tonsilaris, the third more severe, and all of them accompanied, when any thing was swallowed, with a convulsive motion of the throat. I was called in by the family practitioners at the close of the scene. I doubt whether, when the lancet and leeches fail in subduing this affection, that tracheotomy will have much effect. The external jugular vein should be opened either in cynanche laryngea, trachealis, or tonsillaris, in preference to a vein of the arm, or leeches.

pear appendages, and in some instances distinct cartilaginous appendages are found. Their bases, which rest on the cricoid cartilage, are gently concave smooth articular surfaces, and are surrounded by a capsular ligament, the articulation admitting of motion in every direction. In *Fig.* 2 of Plate IV., on the right side, the capsular ligament is cut open to show the articulation, which is marked *f*. The arytenoid are connected to the thyroid cartilage S, by the two vocal ligaments *a*, *a*, which extend from the bases of their anterior or glabello-sternal convex margins, to the angular fossa, on the posterior or dorsal aspect of the thyroid cartilage, where these cords meet or touch each other. The arytenoid cartilages are also connected to the epiglottis Q, by delicate broad ligamentous membranes, marked *b*, in *Fig.* 2 of Plate IV., extending between the apices of the arytenoid and the root and sides of the epiglottis, which are named the lateral ligaments of the epiglottis.

The space between these cords, or the entrance into the windpipe, is named the glottis. Immediately above, or atlantad to these two ligaments *a*, *a*, are two small pouches, or sacculi, or recesses, marked v, in *Fig.* 2 of Plate IV., named the ventricles of the larynx, which are formed of the mucous membrane of the larynx. Two ligaments are situated immediately above or atlantad to these ventricles, and extend between the arytenoid and the thyroid cartilages, from the centre of the convex anterior margin of the arytenoid, immediately above or atlantad to the vocal chord, and are attached to the angular fossa on the posterior or dorsal aspect of the thyroid cartilage, also immediately above or atlantad to the vocal chords; so that the fissures or ventricles are between these ligaments and the vocal chords.

The epiglottis Q, in Plate II., in *Fig.* 1 of Plates III.

IV. and V., situated at the root of the tongue, which it very much resembles in appearance, is a small cartilaginous body, attached to the upper margin of the thyroid cartilage and the os hyoides, through the medium of ligaments, but more so to the former than the latter. In *Fig*. 2 of Plate IV., the epiglottis Q is partially bent backwards and downwards, which brings into view a small ligament, marked *d*, extending between its base and the body of the os hyoides x: the base is also connected to the notch of the upper margin of the thyroid cartilage, so that a triangular space is left between these two ligaments, the epiglottis, and that extending between the os hyoides and the notch of the thyroid cartilage, which is filled up with ligamentous substance. The lateral ligaments of the epiglottis, marked *b*, in *Fig*. 2 of Plate IV., extend between the sides of the epiglottis and the tips of the arytenoid cartilages. Other membranous ligaments extend upwards from the sides of the epiglottis, to the sides of the fauces, as represented in *Fig*. 1 of Plate III.

The os hyoides x, in Plate VII. of Part II., and in Plates I. II. III. *Fig*. 1., and IV. *Fig*. 2, situated horizontally at the root of the tongue, is a slender round bone, of the shape of the Greek *υ*, from which it has got its name, and consists of a body and two cornua. All the views excepting that in *Fig*. 2 of Plate IV., are representations of the outer convex aspect of the bone, and give a more natural appearance than this. In this, however, which is an internal or central view, we perceive the body of the bone x, and the two cornua *x*, *x*; and extending outwards from the body x, we observe two little projections, named appendices.* The body is much thicker and stronger

* Syn. Styliform processes, crura superiora, ossa graniniformia.

than the rest of the bone, is convex outwardly, or peripherad, having a delicate perpendicular ridge in the centre, and concave inwardly or centrad, and until mature age it is not joined to the cornua by cartilage. There are several small elevations and depressions made by the muscles, already described, and therefore unnecessary to be particularized at present. The cornua extend laterad and iniad or dorsad, and end in small round points, or tubercles, from which moveable cartilages project, to meet the superior cornua of the thyroid cartilage.

I shall now proceed to the investigation of the muscles of the larynx, of which there are several.

The crico-arytænoideus posticus* *m*, *Fig.* 1, Plate IV., situated on the posterior aspect of the cricoid cartilage, as its name indicates, derives its origin from the flattened surface of the cricoid cartilage N, as represented in *Fig.* 2, ascends with oblique fibres, to be inserted in the posterior aspect of the root of the arytenoid cartilage *c*. The function of this muscle is to inflect directly backward the arytenoid cartilage, and through it, to render tense the vocal chord.

The crico-arytænoideus lateralis† *p*, is merely the outer or lateral portion of fibres of the preceding muscle, and therefore will have the effect of pulling the arytenoid cartilage backwards and outwards, and by this means separate the vocal chords, so as to widen the glottis.

* Syn. Propriorum laryngis quintus et sextus : Secundus musculorum laryngis seu par cucullare : Ex propriis laryngis musculis posterior : Crico-arytænoideus : Crico-arytænoideus posterior : Dilatateur postérieur : Crico-creti-arithénoïdien : Le crico-aryténoïdien postérieur.

† Syn. Propriorum laryngis septimus et octavus : Musculorum laryngis tertius : Ex propriis laryngis musculis, internorum primum par : Le crico-aryténoïdien-lateral : Le crico-lateri-arithénoïdien.

The arytænoidei obliqui* *r*, *r*, are short muscular fibres, extending from the base of the one arytenoid cartilage to the apex of the other, mutually crossing each other; one of them, however, is occasionally deficient. Their function is to approximate these cartilages, and through their medium to diminish the aperture of the glottis.

The arytænoideus transversus† *t*, is a short arrangement of muscular fibres, which extend directly across from the one arytenoid cartilage to the other, and are attached to the inner or mesial aspect, from the apex to the base. Its function is to approximate the arytenoid cartilages, and thus to narrow the glottis.

The thyro-arytænoideus‡ *g*, derives a broad extensive origin from the interior or central surface of the thyroid cartilage, and ascends with converging fibres, to be inserted in the outer aspect of the base of the arytenoid cartilage, embracing the ventricle of the glottis in its course. Its function is to pull the arytenoid cartilage forwards, backwards, and outwards, so as either to stretch or relax the ligaments of the glottis, and by its forming the wall of the ventricle and the lip of the glottis, it is the chief muscle employed in the modulation of the voice.

* Syn. Arytænoideus minor: Thyro-arytænoïdes obliquus atque ary-epiglottidæus: L'aryténoïdien croisé, le crico-aryténoïdien supérieur et l'aryténo-epiglottique: L'aryténoïdien oblique: L'aryténoïdien.

† Syn. Propriorum laryngis undecimus ac duodecimus: Musculus extremus laryngis omnium minimus: Musculus laryngis conjuge destitutus: Arytænoïdeus: Aristænoideus major: Arytænoïdeus proprius: Ary-arytænoïdis fibræ interiores: Arytænoïdes: Arytenoïdien transversal.

‡ Syn. Propriorum laryngis nonus et decimus: Ex propriis laryngis musculis, internorum secundum par: Quartum par laryngis propriorum: Thyro-arytænoïdes; una cum thyro-epiglottidæo majore: Thyreo-arytænoïdeus: Le thyro-arytenoïdien.

The thyro-epiglottideus and arytæno-epiglottideus muscles, are so delicate as scarcely to be distinguishable; and, as their names indicate, they extend between these different cartilages. The arytæno-epiglottideus muscle is represented in *Fig.* 1 of Plate IV., marked *q*, consisting of very slender fibres, which run from the apex of the arytenoid cartilage *c*, along the outer aspect of the rima glottidis, to the side of the epiglottis Q. This muscle is so delicate as to be more distinctly seen when the mucous membrane is allowed to remain on, than when dissected off. The function of this pair of muscles is to approximate the epiglottis to the arytenoid cartilage, and thus to shut the glottis in deglutition.

The thyro-epiglottideus arises from the thyroid cartilage, and is inserted in the side of the epiglottis; but the fibres are so pale and separated, as to be with difficulty seen. These fibres assist the arytæno-epiglottideus in its functions.

When the pharynx, larynx, and inferior maxillary bone have been removed, three pair of muscles are found on the anterior or glabello-sternal aspect of the cervical vertebræ, viz. the longi colli L, the recti antici majores R, and the minores r, represented in Plates I. and II., and in *Fig.* 1 of Plate III.

The longus colli* muscle, marked L in Plate II. is situated on the anterior aspect of the cervical vertebræ, close to the mesial line, and derives a fleshy and tendinous origin from the sides of the bodies of the three atlantal or superior dorsal, and from the transverse processes of the four or five inferior or sacral cervical vertebræ; the fibres

* Syn. Pars eadem primi et secundi dorsum moventium: Primi cervicis musculi: Pars alterius lateris musculi stomacho subjectorum: Longus: Cervicem flectentium primi paris, sive longi: Le long du cou: Pré-dorso-atloïdien: Pré-dorso-cervical.

ascending obliquely mesiad, to be inserted in the bodies of all the cervical vertebræ. The function is to inflect the neck laterad, and when both muscles are in action, to inflect it directly forwards or sternad.

The rectus capitis anticus major,* marked R, in Plates I. and II., and in *Fig.* 1 of Plate III., is situated immediately on the lateral aspect of the upper half of the longus colli, derives a fleshy and tendinous origin from the anterior aspect of the transverse processes of the third, fourth, fifth, and sixth cervical vertebræ, and ascends to be inserted in the cuneiform process of the occipital bone, anterior or glabellar to the condyle. Its function is to inflect the head slightly laterad, and when both muscles act, directly forwards or sternad. It has also a slight effect in rotating the head on the vertebra dentata.

The rectus capitis anticus minor† muscle r, in *Fig.* 1 of Plate III., is also situated on the anterior or glabellar aspect of the cervical vertebræ, and is obscured by the rectus major; it derives a fleshy origin from the anterior aspect of the body of the atlas, and ascends to be inserted in the cuneiform process of the os occipitis, nearer the condyle, and more laterad than the rectus major. Its function is to inflect the head forwards or sternad.

The scaleni muscles, which I shall next describe, are divided variously by different authors, some making one,

* Syn. Pars eadem primi et secundi dorsum moventium, pars in os occipitis inserta: Primi cervicis musculi pars occipitio annexa: Nonus musculus capitis: Alterius lateris musculi stomacho subjectorum, portio in occipitis os inserta: Qui cum mastoideo caput flectit: Rectus internus major: Rectus capitis internus major: Le grand droit antérieur de la tête: Grand trachelo-sous-occipital: Grand trachelo-basilaire.

† Syn. Rectus internus minor: Le rengorgeur oblique: Rectus anticus minor: Le petit droit antérieur de la tête: Petit trachelo-sous-occipital: Petit trachelo-basilaire.

and others no less than five. I shall follow the arrangement of Boyer, who makes only two, as it is more natural and simple.

The scalenus anticus* muscle, marked L, in Plates I. VII. and VIII. of Part II., is situated on the lateral aspect of the cervical vertebræ, immediately exterior or lateral to the longus colli, and separated from the scalenus posticus by the subclavian artery and axillary plexus of nerves; it arises by distinct tendons from the fourth, fifth, and sixth cervical vertebræ, which soon become fleshy, and form a flat muscle, which is inserted in the tubercle, (marked *h*, in *Fig.* 8 of Plate II. in Part I.), on the atlantal surface of the first rib, marked 64, in Plates VII. and VIII., near its cartilage.† The function of this muscle is to inflect the neck laterad, and when the neck becomes the fixed point, to elevate the ribs, as in active inspiration; when both muscles act, they bend the neck and head sternad or forwards.

The scalenus posticus‡ muscle, marked 50, in Plate VII. of Part II., and in Plate VI. of Part IV., is situated immediately dorsal to the scalenus anticus L, being only separated by the subclavian artery and the axillary plexus of nerves; it derives its origin from the transverse processes of all the cervical vertebræ, by distinct tendons, and descends to be inserted in the atlantal surface of the first rib, nearer its head than the insertion of the scalenus

* Syn. Tertius et quartus dorsum moventium: Secundus cervicis musculus: Septimus thoracis: Scalenus: Par triangulare: Scalenus primus: The first scalenus: Le premier scalène: Costo-trachélien: Trachelo-costal.

† The scalenus anticus muscle relates to the securing of the subclavian artery, as described in page 71 of Part II.

‡ Syn. Tertius et quartus dorsum moventium: Secundus cervicis musculus: Octavus et nonus thoracis: Scalenus: Par triangulare: Scalenus secundus et tertius: Le second scalène: Scalenus minimus, lateralis, medius, et posticus: Costo-trachélien: Trachelo-costal.

anticus, and also in the atlantal edge of the second rib, near its articulation with the dorsal vertebræ. Its function is to inflect the neck laterad, and when the neck is a fixed point, to elevate the ribs, as in active respiration; when both muscles act, they bend the neck and head slightly dorsad or backwards.

I shall now proceed to the muscles of the face, which, I formerly observed, should have been examined first. Great care is requisite in dissecting these, as they are either adherent to the skin, or involved in the adipose substance, according to the emaciation or plumpness of the countenance. They are mostly all represented in Plate X. of Part II.

The student should begin with the occipito-frontalis q, and then proceed in succession to the orbicularis palpebrarum w, the compressor naris n, the levator labii superioris alæque nasi i, the zygomaticus minor e, the zygomaticus major a, the depressor anguli oris b, the orbicularis oris f, the depressor labii inferioris 70, the levator labii inferioris, the depressor labii superioris alæque nasi, the buccinator h, and the masseter l. The different superficial muscles of the face should be developed at once, as they are so blended with each other, that the student cannot comprehend them until this is done.

The occipito-frontalis* muscle q, in Plate X. of Part II., is chiefly a tendinous expanse, situated between the integuments of the scalp and the periosteum of the cranium, adhering intimately to the former. It derives its origin either from the anterior or posterior aspect of the

* Syn. Pars carnea anterior, musculosa frontis cutem movens substantia: Partes ejus carneæ posteriores sunt supercilium trahentes et musculi frontis: Occipitii musculi, et musculus frontis: Occipitales, et musculi frontales: Musculi cutis frontis: Epicranius: Les muscles occipitaux, et les muscles frontaux: Muscle épicrane.

cranium, by two fleshy slips, or bellies; the anterior arise from the superciliary ridges of the frontal bone, where they are incorporated with the corrugatores superciliorum, and the orbiculares palpebrarum, and where they send down a fleshy slip to the compressor naris and levator labii superioris alæque nasi. The two fleshy bellies ascending on the cranium, separate more and more, assume a semicircular shape, and are lost in the tendinous expanse, before they arrive at the coronal suture: this expansive tendon proceeds backwards or iniad, and on each side or laterad, until it again forms two fleshy bellies, which are attached to the superior transverse ridge of the occipital bone, and to part of the temporal bone continuous with it. These posterior bellies are much stronger both in their carneous and tendinous fibres, especially the latter, than the anterior. The tendinous expanse unites both the anterior and posterior fleshy bellies to each other, and descends on each side superficial to the temporal aponeurosis, and beneath or centrad to the attollens aurem r, towards the ear, where it is attached to the zygoma.*

To display this muscle, a longitudinal incision must be made from the root of the nose over the cranium, to the superior transverse ridge of the occipital bone, cautiously through the skin, when the peculiar granulated fat will direct the student that he has arrived at the tendinous expanse. The skin is then to be carefully dissected off, the dissector never proceeding deeper than this granulated fat.

The function of the occipito-frontalis muscle is to cor-

* The occipito-frontalis is materially concerned in punctured wounds of the scalp. When inflammation supervenes, an incision is made across the fibres of the tendon to remove the tension, and when suppuration takes place, the same direction of incision is made. This muscle is also concerned in opening the temporal artery, see Part II. page 48.

rugate the skin of the scalp and forehead, to elevate the eye-brows and eye-lids, to wrinkle the skin of the nose, and to assist in knitting the eye-brows.

The orbicularis palpebrarum* muscle w, in Plate X. of Part II., situated between the skin and the eye-lids, is a delicate arrangement of circular muscular fibres, deriving their origin from the nasal process of the superior maxillary bone, encircling the upper and lower eye-lids, or tarsi, and inserted in the outer edge of the orbitar process of the superior maxillary bone, near their origin. Here they are intimately connected with the ligament of the tarsi, and more or less so with the lacrymal sac. As the fibres sweep round the lower eye-lid, they adhere to the tarsus, and overlap and join the fibres of the levator labii superioris alæque nasi i, and also those of the zygomaticus minor e, which latter is frequently a slip of this muscle. As the fibres run round the upper eye-lid, they adhere to the tarsus, to the occipito-frontalis, the corrugator supercilii, and the internal angular process of the os frontis. To dissect this muscle, nearly as much care and patience are requisite, as in the displaying of the occipito-frontalis, and the student should display first the fibres of the lower, as they are much bolder than those of the upper eye-lid.

The function of this muscle is to open or shut the eye-lids, to compress the eye-ball and the lacrymal gland, and to convey the tears towards the puncta lacrymalia.†

The student may now proceed either to the examina-

* Duo palpebrarum musculi: Palpebrarum primus, orbicularis: Exterior qui totum oculum ambit: Orbicularis palpebræ musculus major: Orbicularis latus cum ciliari: Qui claudentes palpebras, sive semicirculares: Sphincter: Orbicularis oculi: Le muscle orbiculaire des paupières: Naso-palpébral: Maxillo-palpébral.

† The orbicularis palpebrarum relates to the opening of the lacrymal sac in fistula lacrymalis. This muscle, and no other, should be cut in the operation.

tion of the corrugator supercilii, or the compressor naris. I shall describe the latter here, as the former will be represented in one of the plates of the eye.

The compressor naris* muscle n, Plate X. of Part II., situated across the nose, immediately beneath the integuments, is a delicate arrangement of muscular fibres, deriving their origin from the ala nasi, and the levator labii superioris alæque nasi, and ascending with parallel fibres to the dorsum or bridge of the nose, where they join those of the opposite side, and the fibres of the occipito-frontalis. Their function is to compress or expand the anterior apertures of the nares, and to corrugate the skin of the nose.

The levator labii superioris alæque nasi† muscle i, Plate X. of Part II., situated between the eye and the side of the nose and upper lip, derives its origin from the nasal process and the margin of the orbitar and malar processes of the superior maxillary bone, onwards to the cheek-bone, from which the fibres descend obliquely inwards, to be inserted in the skin of the upper lip and orbicularis oris, and cartilaginous ala of the nose. In some subjects, there is a slight separation of the origin, the portion which originates from the nasal process being apart from that which arises from the orbitar process, and hence the muscle is divided into two by some

* Syn. Nasum dilatantes: Frontalis pars per dorsum nasi ducta: Elevator alæ nasi: Transversus: Fronto-nazal: Procerus nasi: Pyramidal du nez.

† Syn. Musculus supercilii musculo junctus, superiori labro insertus: Ex propriis qui superius labrum sursum trahit: Pars primi nasi alas abducentis: Dilatator seu retractor alæ nasi et elevator labii superioris: Pars elevatoris labii superioris proprii: Elevator proprii labii superioris seu incisorius: La grande et la petite portion de l'incisif latéral: Releveur de la lèvre supérieure et de l'aile du nez: Grand sus-maxillo-labial, et moyen sus-maxillo-labial: Maxillo-labii-nazal, et orbito-maxilli-labial.

authors. The origin is overlapped by the orbicularis palpebrarum.* The function of this muscle is to elevate the upper lip, and to expand or dilate the anterior aperture of the nares.

The zygomaticus minor muscle† e is a very delicate assemblage of muscular fibres, which are frequently deficient, situated on the outer or inio-lateral margin of the levator labii superioris alæque nasi muscle i, with which they are not unfrequently connected. This slender muscle is either a production of the orbicularis palpebrarum w, or derives its origin from near the middle of the external surface of the os malæ, and descends to be attached to the orbicularis oris f, and the upper lip, near the angle of the mouth. Its function is to elevate the upper lip, especially the angle of the mouth.

The zygomaticus major muscle‡ a, is a bolder assemblage of muscular fibres than the minor, having a similar course, and situated on its outer or inio-lateral margin. It derives its origin from the zygomatic process of the os malæ, and descends obliquely to the angle of the mouth, where it is attached to the skin, the orbicularis oris, and the depressor anguli oris. Its function is to elevate the angle of the mouth upwards and outwards. The platysma myoides, already described, may be with great propriety dissected at this period, as its fibres are blended with those of the depressor anguli oris b.

The depressor anguli oris§ muscle b, is a triangular

* The levator labii superioris is concerned in the division of the infra-orbitary nerve in neuralgia, as described in page 65 of Part II.

† Syn. Le petit zygomatique: Petit zygomato-labial.

‡ Syn. Unus ex quatuor musculorum labris propriorum: Zygomaticus: Primi paris, sive attollentis labium superius; Le grand zygomatique: Grand zygomato-labial.

§ Syn. Pars alterius lateris primi musculi eorum qui buccas et labra movent: A menti lateribus adscendens in labrum supernum: Labium superius deorsum

arrangement of muscular fibres, extending between the inferior maxillary bone and the angle of the mouth, immediately beneath the integuments. It derives an extensive origin from the base of the inferior maxillary bone, (marked with the letters *a*, *a*, in *Fig.* 25 of Plate VI. of Part I.), and ascends with converging fibres, to be attached to the angle of the mouth, where its fibres mingle with those of the orbicularis oris f, and those of the zygomaticus major a. In its course the outer or iniolateral fibres are blended with those of the platysma myoides F. Its function is to depress the angle of the mouth.

The orbicularis oris* muscle f, is a circular arrangement of muscular fibres encircling the lips, formed apparently in some measure by the insertion of the various muscles around, viz. the levator labii superioris alæque nasi, the depressor labii superioris alæque nasi, the two zygomatici, the levator anguli oris, the depressor anguli oris, and the depressor labii inferioris, with which they are connected. The fibres adhere intimately to the skin, so that they are with some difficulty displayed elegantly; they run along the upper and lower lips, and are either continuous or decussate at the angles: to me they appear to be continuous. Their function is to open or shut the

movens, a mento in illud labium delatus: Ex propriis quo superius labrum deorsum movetur: Quarti paris propriorum labiis: Depressor labiorum: Depressor labiorum communis: Labrorum communis depressor, seu triangularis: Le triangulaire ou abaisseur de l'angle des lèvres: Maxillo-labial: Sous-maxillo-labial.

* Syn. Moles carnea, musculosa tamen, quæ utrumque labium format: Musculus orbicularis: Quartum par constringens: Constrictor labiorum sive orbicularis: Sphyncter labiorum: Les sur-demi-orbiculaires: Le muscle orbiculaire des lèvres: Labial.

mouth, and to perform various motions in speech, gesture, and deglutition.*

The levator anguli oris† muscle o in Plate IX. of Part II., situated beneath or centrad to the levator labii superioris alæque nasi i and the zygomatici e, a, derives its origin from the superior maxillary bone immediately below or basilad to the infra-orbitary foramen *o*, and the infra-orbitary nerve 2; and descends obliquely to be inserted in the angle of the mouth, where its fibres mingle with those of the orbicularis oris f, and the depressor anguli oris b. Its function is indicated by its name.

The depressor labii superioris alæque nasi‡ muscle *s*, in *Fig.* 3 of Plate IV. of Part IX., is situated between the upper lip and the alveolar processes of the superior maxillary bone. To display it, the upper lip must be held up, as represented in the diagram, and the lining membrane of the mouth carefully removed, when the fibres will be seen to arise from the alveolar processes of the two incisive and canine teeth of the one side, and to ascend to be inserted in the upper lip, and cartilaginous ala of the nose, the fibres intermingling with those of the orbicularis oris. Its function is to antagonize the levator labii superioris alæque nasi, and consequently depresses the upper lip, and contracts the anterior aperture of the nares by pulling downwards the cartilaginous ala of the nose.

* This muscle is concerned in the operations for hare-lip and cancer of the lips.

† Syn. Secundus ad latera trahens sive abducens: Elevator labiorum: Elevator labiorum communis: Elevator labiorum seu caninus: Le canin: Petit sus-maxillo-labial.

‡ Syn. Constrictor alæ nasi ac depressor labii superioris: Depressor labii superioris proprius: Musculus labri superioris arctandis naribus communis, ac myrtiformis seu pinnarum dilatator proprius: L'incisif mitoyen: Depressor alæ nasi: Labial: Maxillo-alveoli-nasal.

The depressor labii inferioris* muscle, marked 70 in Plate X. of Part II., situated between the lower lip and the chin, is a scattered arrangement of delicate muscular fibres, adhering so intimately to the skin that they are with difficulty displayed. These fibres derive their origin from the base of the inferior maxillary bone, as indicated in *Fig.* 25 of Plate VI. of Part I., between the symphysis menti *c* and midway between the letters *a*, and ascend obliquely mesiad, uniting with those of the opposite side, to be inserted in the lower lip, the orbicularis oris, and the skin. The origin is overlapped by that of the depressor anguli oris. The function of this muscle is indicated by its name, depressing the lower lip downwards and laterad; and when both muscles act, depressing the lip directly downwards or basilad.†

The levator labii inferioris,‡ marked *i* in *Fig.* 3 of Plate IV. of Part IX., is situated on each side of the frenum labii inferioris; and in order to display it, the lower lip must be held downwards, as represented in the drawing. This muscle derives its origin from the alveolar processes of the incisive and canine teeth, and descends in a fan-like shape, to be inserted in the lower lip. It can generally be seen shining through the lining mucous membrane of the mouth. This muscle, as its name indicates, elevates the lower lip.§

* Syn. Unus ex quatuor musculorum labris propriorum duobus inferioribus: A quo labrum inferius deorsum movetur: Tertii paris, deprimentis inferius labrum: Quinti paris propriorum labiis: Depressor labii inferioris: Depressor labii inferioris proprius: Labri inferioris depressor proprius: Le quarrè du menton ou abaisseur de la lèvre inférieure: Mento-labial: Mentonnier-labial.

† The depressor labii inferioris is concerned in cancer of the lower lip.

‡ Syn. Elevator labii inferioris: Elevator labii inferioris proprius; Elevator menti: De la houppe du menton, ou l'incisif inferieur: Portion de mento-labial: Sous maxillo-cutané.

§ The levator labii inferioris is in some degree concerned in dividing the branch of the inferior maxillary nerve, which emerges at the mental foramen.

The masseter muscle,* marked 1 in Plates IX. and X. of Part II., is a bold, tendinous, and fleshy mass, situated on the side of the face, extending between the cheek-bone and the lower jaw-bone. It derives its origin, which is partly fleshy and partly tendinous, from the inferior or basilar edge and zygomatic process of the os malæ, and from the zygomatic process of the temporal bone; and descends along the ramus of the inferior maxillary bone, to be inserted partly in the ramus, and partly in the angle of the same bone. Its function is to approximate the inferior to the superior maxillary bone, and is therefore employed in breaking and triturating the food, but more so in the former than in the latter action.†

The buccinator muscle‡ h, in Plates VIII. IX. and X. of Part II., situated beneath or centrad of the masseter, zygomatici, and depressor anguli oris muscles, and immediately exterior or peripherad of the mucous membrane of the mouth, derives a tendinous and fleshy origin from the alveolar processes of the superior and inferior maxillary bones, and proceeds with straight or horizontal fibres to be inserted in the angle of the mouth and orbicularis oris. The function of this muscle is to inflate or compress the cheeks, and to draw the angle of the mouth backwards, and therefore employed in mastication to move the bolus of food from one side of the mouth to the other.§

* Syn. Inferiorem maxillam moventium alterius lateris secundis, seu masseter: Masseterius et mansorius dictus: Masseter: Tertius attollens maxillam masseter: Tertii paris laterales: Zygomatico-maxillaire.

† The masseter muscle is concerned in extirpation of the inferior maxillary bone, when affected with spina ventosa, and also in luxation of this bone.

‡ Syn. Buccarum, labrorum, et nasi alarum secundus alterius lateris: Musculus buccæ: Bucco: Contrahens communis buccarum labiorumque: Le buccinateur: Bucco-labial: Alveolo-maxillaire.

§ The buccinator is concerned in wounds and operations of the face, and in fistula of the parotid duct, this tube piercing the muscle, as seen in Plate X. of Part II., marked x.

The temporal muscle* u, in Plates VIII. and IX. of Part II., and in Plate II. of Part IX., situated on the side of the face, beneath the occipito-frontalis muscle, and having a strong tendinous aponeurosis covering it, derives its origin from the temporal depression of the frontal, parietal, temporal, and sphenoid bones; and descends with converging fibres below the jugum or zygoma, to be inserted in the coronoid process of the inferior maxillary bone, and also along the ramus. The tendinous aponeurosis of this muscle is attached all round the muscle to the scabrous ridge, marked *e* in *Fig.* 1 of Plate IV. of Part I., and to the zygoma. The muscle has elegant glistening tendinous fibres exteriorly or peripherad, and fleshy fibres internally or centrad. The function of this muscle is to approximate the inferior to the superior maxillary bone; and it is therefore employed in breaking and triturating the food, but more so in the former than in the latter function.†

The two pterygoid muscles should now be investigated; they are situated centrad or within the ramus of the inferior maxillary bone, and are named external and internal, appellations however which do not distinguish them clearly from each other. To display them with satisfaction, the inferior maxillary bone should be sawn midway between the symphysis menti and angle of the bone.

The pterygoideus internus‡ muscle n, in Plate VIII. of

* Syn. Inferiorem maxillam moventium primus alterius lateris musculus, seu temporalis: Le temporal ou crotaphite: Temporo-maxillaire: Arcadi-temporo-maxillaire.

† The temporal muscle is concerned in extirpation of the inferior maxillary bone, when affected with spina ventosa, and in luxation of this bone.

‡ Syn. Tertius musculus qui in ore latitat: Musculus in ore latitans: Latens in ore: Quinti paris maxillam abducens: Paris pterygoidis sive alaris interni: Pterygoides interior: Le grand ptérygoïdien ou ptérygoïdien interne: Le grand ptérygo-maxillaire: Ptérygo-anguli-maxillaire.

Part II., and in Plates II. and III., *Fig.* 1, situated internally or centrad to the ramus of the inferior maxillary bone, derives its origin from the fossa between the two pterygoid plates of the sphenoid bone, and descends to be inserted on the inner or central aspect of the angle, and part of the ramus of the inferior maxillary bone. The internal maxillary artery *f* separates this muscle from the pterygoideus externus. Its function is to move the inferior maxillary bone on the superior from side to side or laterally, and hence employed in triturating the food in mastication.*

The pterygoideus externus† muscle t, in Plate VIII. of Part II., and in Plates II. and III., *Fig.* 1, of Part IX., situated coronad or above the pterygoideus internus, and separated from it by the internal maxillary artery *f*, derives its origin from the external pterygoid plate of the sphenoid bone, the bulbous process of the superior maxillary bone, and the root of the temporal process of the sphenoid bone, and extends directly across with horizontal fibres to be inserted in the cervix and capsular ligament of the articulation of the inferior maxillary bone. The function of this muscle, like that of the pterygoideus internus, is to move the inferior maxillary bone laterally, or from side to side; and it is therefore employed in triturating the food in mastication.‡

Having examined all the muscles in this region, I shall

* The pterygoideus internus muscle is concerned in extirpation of the inferior maxillary bone, and in luxation of this bone.

† Syn. Novi paris musculorum : Musculi temporalis illa pars quod ab externa sede processuum, quos vespertilionum alis comparamus : Quintum par exerendæ Fallopio adscriptum : Quarti paris pterygoïdes abducentis : Pterygoïdes exterior : Le petit pterygoïdien ou pterygoïdien externe : Petit pterygo-maxillaire : Pterygo-colli-maxillaire.

‡ The pterygoideus externus is concerned in extirpation of the inferior maxillary bone, and in luxation of this bone.

now proceed to the ligaments of the articulation of the inferior maxillary bone.

The condyloid process of the inferior maxillary bone is articulated simply by a capsular ligament, marked *c* in Plates I. II. and III., *Fig.* 1, of Part IX. This capsule arises around the glenoid cavity *e* of the temporal bone, glides over the condyle *b* of the inferior maxillary bone, to be inserted round the cervix. Within this capsule is interposed an interarticular cartilage *h*, which is concave on both surfaces, and adheres to the capsular ligament.*

* In page 61 of Part I., the motions of the inferior maxillary bone are described; and it is there mentioned that luxation occurs most frequently in children, in consequence of the shallow state of the articulation. This bone is only luxated forwards, an accident which occurs most commonly while yawning; it has been however produced by laughing, gaping, or biting too large an object; also by a blow on the chin while the mouth is wide open, and during the extraction of a tooth. Considerable pain is experienced, which the patient is unable to describe from the extended state of the mouth, the saliva flows in profusion, a large depression is felt before the ear, a prominence under the cheek-bone, and the cheeks and temples are flatter than usual. The accident cannot be mistaken. If not reduced, the patient can neither speak nor swallow for the first five days. In a few weeks the symptoms are not so strongly marked, the chin gradually approximates the superior maxilla, the individual recovers progressively the power of speaking and swallowing, but still stammers and slavers from the mouth. Occasionally only one condyle is luxated, and then the mouth is distorted and turned to one side, while the teeth of the two maxillæ do not correspond. To reduce this luxation, the operator puts on a pair of thick gloves, inserts his thumbs far back on the last molares, and places his fingers under the chin; he then gradually depresses the molares, while at the same time he elevates the chin, and when the luxation is reducing, the operator should endeavour, by gliding his thumbs to the sides, between the teeth and the cheeks, to prevent them being checked. If gloves are not at hand, cotton or linen may be rolled round the thumbs. When the reduction is accomplished, a four-headed roller should be applied, placing the centre or union of the heads under the chin, and then carrying two of the ends upwards to the crown of the head, and the other two backwards to the occiput. The patient should abstain from eating any hard food for some time, as this luxation is very liable to recur.

When the greater portion, or the whole of the inferior maxillary bone, requires to be removed for spina ventosa, the operator must divide one or both of the

I have not yet described the ligaments peculiar to the atlas and dentata. These are represented in *Fig.* 2 of Plate III. of Part IX.

In this figure, the letters D point out the extension of the dura mater, or theca vertebralis; and the letter E the ligamentum commune posticum, both of which are reflected off, to show these ligaments. The ligamentum

cheeks from the angle of the mouth backwards or iniad, to the parotid gland, avoiding its duct; (the facial artery will be wounded in this incision, and require to be secured); he should then dissect the lower lip and the lining membrane of the mouth from the bone, cutting across, at the same time, the origins of the levator labii inferioris, the depressor labii inferioris, and the depressor anguli oris muscles, and divide the maxillary bone, at the symphysis menti, with the saw, which will give great facility to the performance of the remainder of the operation; and in doing which one of the mesial incisive teeth may require to be removed. If only one side of the bone requires removal, he should separate first the insertions of the genio-hyo-glossus, genio-glossus, genio-hyoideus, and anterior head of the digastric muscles, next that of the mylo-hyoideus, thirdly, that of the masseter muscle, keeping close to the bone, fourthly, that of the temporal muscle, keeping in view the internal maxillary artery; probably large bone nippers will answer better to cut across the coronoid process, leaving the division of the insertion of the temporal muscle until the operation is nearly finished. He should now divide the insertion of the pterygoideus internus from above downwards, keeping the back of the knife towards the internal maxillary artery, and cutting across at the same time the osseous branch of the inferior maxillary nerve, with its accompanying artery and vein. When this is done, he will feel the internal maxillary artery pulsating, and will be able to divide the insertion of the external pterygoid muscle, keeping the back of the knife to the artery, and cutting upwards or coronad. Lastly, by depressing the symphysis of the bone, he will now be able to cut around the capsular ligament, and detach the one-half of the bone. In all the cases wherein this dexterous operation has been performed, it has not been necessary to remove the condyle of the bone, and a chain-saw has been used to cut through the ramus; large bone nippers will be found to answer better. Should the whole bone be diseased, the same must be done on the opposite side. After the removal of the bone, the wound in the cheek or cheeks is to be brought together by stitches, adhesive plaister, compresses, and bandages. The patient should be fed on spoon-meat or liquids for some time. When we reflect that spina ventosa attacking this bone is incurable by any milder means, we should not hesitate to perform such an operation. The cases recorded of the operation have fortunately succeeded.

commune posticum E extends, like the anticum, from the foramen magnum of the occipital bone, to the coccyx, but is not so strong a ligament. That portion of the ligamentum commune anticum and posticum, which extends from the foramen magnum of the occipital bone to the atlas, is named by some authors the circular ligament. The ligamentum commune anticum is described in Part VI. page 161. The ligamenta subflava are short strong ligaments, which extend from the ring *b* of the one vertebra to that *b* of the other. One of which is distinctly seen in *Fig.* 6 of Plate XII. of Part VIII., extending between the atlas and dentata. In *Fig.* 2 of Plate III. they are merely covered by the theca vertebralis.

Some of the capsular ligaments of the articular processes are also displayed in *Fig.* 2 of Plate III. The letters c indicate these capsules, one of which, viz. that between the vertebra dentata and the atlas, is cut open to show the pouch; these ligaments adhere around the smooth articular processes of the vertebræ, and are rather delicate capsules. The inferior or sacral c is placed on one of the articular surfaces of the vertebræ.

The intervertebral cartilage C, connecting the bodies of the vertebræ, is also displayed in *Fig.* 2 of Plate III. This is a soft spongy elastic body, with a mucous fluid in the centre.

The transverse ligament of the atlas, marked with the digit 1, in *Figs.* 1 and 2, is a very strong broad ligament, of a yellowish colour, extending between the tubercles of the atlas (marked *i*, in *Fig.* 5 of Plate II. of Part I., the dotted line receding on each side from the letter *i*, indicating the course of the ligament). This confines the processus dentatus of the vertebra dentata, and prevents it disturbing or injuring the spinal cord, during the rotatory motions of the head.

The digits 2 indicate the lateral ligaments, which extend between the sides of the tip of the processus dentatus *n*, and the margin of the foramen magnum *k* (the precise points being marked *n*, in *Fig*. 5 of Plate V. of Part I.) These lateral ligaments are of a round figure, very strong, and moderate the rotatory motions of the head.

The digit 3 points out the perpendicular ligament, which extends from the processus dentatus *n*, to the margin *m* of the foramen magnum *k*. This ligament is of a flattish figure, much more slender than the lateral, and assists in moderating the flexion of the head forwards or sternad.*

The general motions of the vertebræ are detailed in page 8 of Part I. The nodding motions of the head are

* As observed in page 9 of Part I., the vertebræ are in a manner so firmly locked together, by the vertical direction of their articular processes which overlap each other, by the intervertebral cartilage, by the strong ligaments, as the crucial, the common anterior and posterior, the subflava, the capsular, the intertransverse and interspinous, also by a number of short muscles, that dislocation seldom or never occurs. We may therefore always look for fracture of these bones, or fracture and luxation; for when once any of them is fractured, we can easily conceive that luxation may also occur. Thus, suppose the articular processes either of the superior or the inferior vertebra, to be fractured; these articulations may then be easily luxated. Some time ago, I was called to a lady, who, in looking over her bed-room window three stories high, between thirty and forty feet in height, lost her balance, and fell on a large washing-tub, her back striking the edge of the tub. Paralysis of the lower extremities, of the bladder of urine and the rectum continued for two months, when she died. On examination of the spine (the object in question, for it is foreign to my purpose to detail minutely the case), the last dorsal vertebra was found fractured, and the spinal canal obliterated. Mr. C. Bell relates an instance of a subluxation of the last cervical from the first dorsal vertebra, which, however, appears to have been produced by the suppuration more than by the injury. Desault, Petit-Radel, and Chopart, cite each a case, and Boyer talks of a number of examples of the luxation of one of the articular processes of a cervical vertebra, from that of the contiguous vertebra, from which resulted permanent rotation and inclination of the neck towards the side opposite to that of the luxation. In this accident, the position of the head and neck at once distinguishes it, and also the impossibility of turning

performed between the condyloid processes of the occipital bone, and the superior articular processes of the at-

the neck to the opposite side. From the elongation or laceration which would necessarily accrue to the spinal marrow, in any attempt to reduce this luxation, all idea of reducing it must be abandoned. Petit-Radel attempted reduction in a young child, which died in his arms. Desault and Chopart left their patients to nature, and they lived.

Boyer mentions, that in violent flexions of the spine, forwards or sternad, the interspinous ligaments and ligamenta subflava have been ruptured. When the former only were lacerated, no injury of the spinal marrow followed; but when the latter, paraplegia and death resulted.

The occipital condyles have never been displaced from the atlas by external violence, but occasionally by disease. Daubenton, Sandifort, Boyer, Duverney, Schupke, Frank, Rust, and Reil, detail cases of this last event. These arose from scrophulous affections, or caries, or exostosis of either the articular or transverse processes of the atlas, or from the existence of similar tumours on the occipital bone, or petrous portion of the temporal bone. The anterior or posterior portion of the bony ring, or one of the sides of the atlas, has been so pushed to one side, as to diminish the diameter of the foramen magnum a third, the half, and even two-thirds. Notwithstanding so great a displacement of the atlas, and consequent pressure on the spinal cord, individuals so affected have lived for many years, apparently from its taking place gradually, until these tumours have acquired either a prodigious magnitude, or the head has become anchylosed with several of the cervical vertebræ. In these cases, not only was the atlas displaced from the occipital bone, but anchylosis had taken place in the articulation between the processus dentatus and the atlas, and even between the point of the processus dentatus and the occipital bone. Other varieties of displacement and anchylosis were observable. The treatment of this peculiar affection consists in keeping the head and neck as straight as possible, by means of the chin-stay, and in applying blisters, or setons, or issues: only an eschar should be made, and probably the moxa is the best means to produce this.

The vertebra dentata has been displaced from the atlas, particularly its processus dentatus, and this has occurred both from external violence and from disease, and has generally proved very soon fatal. The external violence has in some cases been extremely trifling; thus Petit details a case wherein the lifting a child up by the head produced it, and Mr. C. Bell relates also a case where a man hurling a wheel-barrow forcibly from the causeway upon the pavement, fell upon his chin, and ruptured the transverse, lateral, and perpendicular ligaments. Boyer imagines, that in some instances the perpendicular and lateral ligaments are ruptured, that the processus dentatus slips sacrad of the transverse ligament of the atlas, and that

las; while the rotatory motions of the head are performed between the inferior or sacral articular surfaces of the atlas, and the superior of the vertebra dentata, these latter motions being limited in their extent by the lateral ligaments of the dentata. In these last motions the processus dentatus is prevented pressing on the spinal cord by the transverse ligament of the atlas, and the perpendicular of the vertebra dentata, and also by the ligamentum commune anticum, which is sometimes named the circular ligament, and likewise by the theca vertebralis.

In the two last Parts, I described the minute anatomy of the brain, or sensorium commune, and in this I mean to describe the organs of sense, which are the instruments by which that sensorium becomes acquainted with external objects.

The senses are five in number, viz. seeing, hearing, smelling, tasting, and touch; of these I shall first describe that of smelling, next that of tasting, thirdly, that of hearing, fourthly, that of seeing, and lastly, that of touch; not that I think this the natural anatomical order, but that I am compelled to adopt it, in consequence of the difficulty of procuring perfectly fresh eyes.

I have here to regret, therefore, that owing to the above circumstance, all the plates of the eye are not yet engraved, because, in a naturally connected anatomical

this result happened in the case of a child related by Petit, and to the malefactors executed at Lyons, as detailed by Louis. In all the above cases from accident, death instantly ensued; but should such an event not immediately occur, the patient should be placed on his back, and the head and neck put in such a straight position, as to remove the pressure of the processus dentatus from the spinal cord. In displacement occurring from disease, the patient ought to be laid in the horizontal posture, the chin-stay applied, and eschars made with the moxa. An interesting case of this last is detailed in the 15th volume of the *Edin. Med. and Surg. Journ.* page 417.

order, the eye should be described as the first organ of sense, as some of its nerves proceed to the nose; this latter organ should come next; thirdly, the mouth; fourthly, the ear; and lastly, the skin. In a physiological view of the senses, this order should be reversed. I have no alternative, therefore, but to begin with the nose. I am happy to say, that only one plate of the eye remains to be engraved, and that it is well advanced.

The nose is delineated in Plates V. and VI. of Part IX., and consists of bones, cartilages, a delicate mucous membrane, several cells, blood-vessels, nerves, and lymphatics. In Part I. page 58, several bones are described as entering into the formation of this organ of sense, viz. the nasal, the superior maxillary, the lacrymal, the frontal, the ethmoid, the sphenoid, the vomer, the inferior spongy, and the palate bones.

The septum narium, marked with the letters *c*, in *Figs.* 1 and 2 of Plate V., and in *Fig.* 1 of Plate VI., formed by the azygos process of the sphenoid, the spinous processes of the palate and superior maxillary, and the nasal lamella of the ethmoid bones, together with the vomer, is completed in the fresh state by an extension of cartilage, onwards to the tip of the nose, where there is also a loose or moveable piece of cartilage, appearing a continuation of the latter, which is covered with skin, studded with bristly hairs, and named columna, and marked D in the same figures. Between these cartilages a small elliptical depression is observable, represented in the plates by a slight shading.

On each side of the anterior aperture E of the nares, in *Fig.* 2 of Plate V., is placed an irregularly oblong shaped cartilage B, which forms the ala or pinna of the nose, and which is named the lateral cartilage. This is connected

by a ligamentous membrane C, to the nasal and superior maxillary bones, and to the columna D, and the perpendicular cartilage A. The perpendicular cartilage A, of a long roundish figure, extends from the longitudinal nasal suture, resting on the cartilaginous septum narium, to the columna D, on which it also rests; and, in some instances, appears merely a thickening or overlapping of the cartilaginous septum narium. This is named the dorsum of the nose, and the one extremity is termed the tip, apex, or point of the nose, and the other extremity, or rather the point where the nasal bones join the frontal bone, is styled the root or radix. At the back or inial part of the nares, we have two large apertures, one of which is marked T, in *Fig.* 1 of Plate V., leading to, or communicating with the pharynx b; and here there are also lateral cartilages, on one of which the letter T is placed. Besides these four large apertures to and from the nares, there are all those to the cells and cavities, and to the Eustachian tubes, one of the latter of which is marked Z in this figure; and also the apertures to the lacrymal duct, indicated by the bristle 3. All these bones and cartilages are observed in the figures of Plates V. and VI., to be clothed with a delicate vascular mucous membrane,* having an infinite number of small mucous follicles, and on which the nerves of smelling are minutely and extensively ramified. This mucous membrane is a continuation of the cutis vera, beautifully modified for this higher order of function. Besides investing all the bones and cartilages of the nares, it extends into all the cells, cavities, and ducts, connected with the nares, becoming, however, much thinner and more delicate. These cells are delineated in *Figs.* 1 and 3

* Syn. Schneiderian membrane.

of Plate V., and in *Figs*. 1, 2, and 3, of Plate VI.; the frontal sinuses being marked *f*, the ethmoidal cells *f**, *f**, *f**, the palatine cell P, the sphenoidal cell *g*, and the antrum maxillare A. The bristle marked 3 in *Fig*. 3 of Plate V., and in *Figs*. 1 and 2 of Plate VI., is introduced along the lacrymal or nasal duct, showing its course from the nose upwards, or from the eye downwards to the nose, the latter being the natural course of this conduit for the tears from the eye to the nose. The aperture leading from the orbit is developed in Plate X. *Fig*. 2, marked G. This tube, as already mentioned, is formed by the lacrymal, superior maxillary, and inferior spongy bones, as illustrated in Plates IV. V. and VI. of Part I., and lined with a continuation of the mucous membrane of the nares. In *Fig*. 3 of Plate V. of Part IX., the inferior spongy bone is marked 23, and we observe the bristle 3 emerging from below this bone; in *Fig*. 1 of Plate VI. a considerable portion of this bone 23, has been removed to exhibit the course of this tube; while in *Fig*. 2 of the same Plate, this bone is still further cut up to display this passage. This lacrymal duct conducts the tears from the lacrymal sac at the inner canthus of the eye to the nares, from thence they glide along the floor of the nares, flow out at the posterior apertures T, *Fig*. 1 of Plate V., and down along the velum palati F, to the pharynx *b*, and œsophagus, into the stomach.* The mucous secretion from the extensive surface of the Schneiderian membrane of the nares flows along the same course to the stomach.

* The course of the lacrymal duct should be well understood, being subject to inflammation and diseased secretion, which sometimes ends in thickening of the membrane that closes up the channel, forming the disease named fistula lacrymalis. We sometimes require to introduce a probe, or syringe, into it, either from the nares, or from the eye.

The bristle marked 2 in *Fig.* 3 of Plate V., and in *Fig.* 1 of Plate VI., indicates the aperture or canal of communication of the frontal sinus with the nares. Both the sinus *f*, and its canal, are clearly developed in *Fig.* 2 of Plate VI., the channel being exposed.

The bristle marked 5, in *Fig.* 3 of Plate V., and in *Fig.* 1 of Plate VI., indicates the aperture which leads to the ethmoidal cells; all of which are laid open in *Fig.* 2 of Plate VI., aud where the centre one of the three is, they communicate individually with the nares. Sometimes they communicate directly, and sometimes through the medium of one another.

The bristle marked 7, in *Fig.* 1 of Plate VI., indicates the channel of communication to the palatine cell P, which is seen in *Fig.* 2 of Plate VI., and in *Fig.* 1 of Plate V. The bristle 4 in *Fig.* 3 of Plate V., and in *Fig.* 1 of Plate VI., indicates the mode of communication with the sphenoidal cell *g*.

The bristle marked 6, in *Fig.* 1 of Plate VI., indicates the aperture leading backwards to the antrum maxillare, which is situated between the superior and inferior spongy bones, as will be easily understood by comparing *Fig.* 3 of Plate V. with *Figs.* 1 and 2 of Plate VI., in the last of which figures the aperture is distinctly seen. In *Fig.* 3 of Plate VI., and in *Figs.* 1 and 3 of Plate V. this cavity is fully displayed. In *Fig.* 5 of Plate VI., the delicate mucous membrane, which invests this cavity, is displayed, the bone having been removed. All of these cavities, I have already mentioned, are invested with the mucous membrane of the nares, and all of them have small apertures or canals of communication, in order to prevent the cold atmospheric air being freely admitted.

The nares are supplied with blood by the internal maxillary artery, marked *f*, in Plate VII. of Part II., and

described in pages 46 and 47 of the same Part, and are extremely vascular, being, in health, of a bright red colour. The ophthalmic artery also contributes to supply the nares, giving origin to two small arteries, named ethmoidal, which enter at the foramina orbitaria interna, and are ramified on the ethmoid and other cells in their contiguity.

The nerves which are distributed on the nares, are the first pair or olfactory, the nasal twig of the ophthalmic or first branch of the fifth pair of nerves, and the nasal twigs of the second or superior maxillary branch of the same nerves.

The olfactory nerves, delineated in *Fig.* 7 of Plate VII., in Plates X. XI., *Fig.* 5 of Plate XII., and Plate XIII. of Parts VII. and VIII. of the brain, and marked with the digits 1, are described in page 28 of Part VIII. Their distribution on the mucous membrane investing the turbinated portions *d*, in *Fig.* 3 of Plate V. of Part IX., and the mesial septum *c*, in *Fig.* 1 of Plate V. of Part IX., is so soft and delicate as to be with difficulty depicted.

The fifth pair, or trigeminal nerves, are represented in *Fig.* 7 of Plate VII., and in Plates X. and XI. of Parts VII. and VIII., marked 5, and their origin described in page 31 of Part VIII.; but as the nasal twig of the ophthalmic branch is not seen in the Plates of Part IX., but in those of Part X., and as several other branches of this nerve are not seen in this Part, it appears preferable to defer its description, until I can do it in a connected methodical order. In the meanwhile, the reader is directed* to the nasal twigs which are given origin to by the palatine nerve, marked P, in *Figs.* 4 and 5 of Plate VI. of

* The names of the nervous twigs seen in *Figs.* 4 and 5 of Plate VI., are given in the Index of the Letters of Reference.

Part IX. In *Fig*. 5, where they are better seen, five nervous threads are observed to enter the nares at the spheno-palatine aperture (marked *o*, in *Fig*. 4 of Plate IV. of Part I.) These nervous threads are distributed on the mucous membrane investing the mouth of the Eustachian tube, the sphenoid and other cells contiguous, and the septum narium, while one of them descends along the septum to the foramen incisivum, which it perforates, and unites with twigs of the palatine nerve, marked P, in *Fig*. 1 of Plate VII. These nervous threads are named by some authors, the superior posterior nasal nerves, to distinguish them from other nasal nervous threads, termed the inferior posterior nasal nerves, which are represented in *Fig*. 5 of Plate VI., arising further down from the palatine nerve P, and which are piercing the nasal lamella of the palatine bone, to be distributed on the mucous membrane investing the inferior spongy bone and floor of the nares.*

* In Page 58 of Part I., some observations are made on the structure and configuration of the nares. From the great vascularity of the mucous membrane, and its exposed nature, hemorrhage or epistaxis is a frequent occurrence, but unless it happen in advanced life, it is seldom serious or dangerous. At this period, however, it should be carefully watched. If cold styptic lotions, as vinegar and cold water, or a solution of the sulphate of zinc or copper, have no effect, the posterior apertures require to be plugged up with lint, which is accomplished by introducing either a long-eyed probe (carrying the eye'd-end first), or a double canula armed with the noose of a ligature, along the floor of the nares, keeping close to the mesial septum, backwards to the pharynx, and downwards behind or dorsad, to the velum palati, until the ligature is seen in the throat, when it is to be brought forwards by forceps into the mouth, and then have attached to it a dossil of lint, or piece of sponge, which is to be pulled upwards by the canula and ligature, into the posterior aperture of the naris, so as to shut it up. If the lint or sponge be too large or too small, it must be returned into the mouth and modified accordingly. The canula should then be removed, but the ligature left hanging out at the anterior aperture of the nares, which must be also stuffed with lint. The same steps are to be taken with regard to the other nostril. The patient will be able to breathe through the mouth.

I shall now proceed with the description of the organ of tasting, which may be said to reside in all the soft

Polypous growths frequently shoot from the superior spongy bones, and from every part of the mucous membrane of the nares. The distinctions of the various kinds of polypi, as adopted by Pott, appear, as the late Mr. J. Bell says, to be either unintelligible or nugatory, since they become malignant and fatal from the pressure they produce on the contiguous parts. For, "Polypus," as Mr. Bell justly observes, "is one of the most loathsome and fatal diseases. It is described in terms little suited to convey this idea to the young surgeon, who, while he reads a systematic author, or hears a lecturer talk in slight and familiar terms of the disease, and its cure, little suspects the dismal scenes which are passing in the chambers of the sick, and puts his hand, with little forethought or prudence, to operations the most difficult for a man of experience, the most impossible for an unskilful person to perform."

In all cases of polypi, where it can be accomplished, they should be removed by curved scissors, having blunt points. The forceps, in my opinion, should never be employed, as the scissors can always be used in their stead. The tumours should be seized with a hook or common forceps, which is to be held in the left hand, when the scissors, opened over the tumour, a limb being on each side of it, are to be carried along to the root, which is then to be cut across. The bleeding to be stemmed with lint, dipped in a solution of the nitrate of silver, which is to be applied by a probe, or director, or canula, and held there for a little. Where this line of practice cannot be pursued, the tumour should be removed by ligature. When ligatures are employed, that of catgut, or silver-wire, is applied, by means of a double canula; and this is the best remedy where polypi project and hang down the pharynx. After the tumour is removed either by the scissors or the ligature, the root of the polypus should be touched with caustic, or a small cautery, for several times, in order to stunt its growth. This application, particularly the caustic, produces severe irritation, and frequently requires the part to be soothed with injections of warm water. Caustic used as the sole means, is much too inefficient, and produces too much irritation. I have witnessed violent headach and smart fever induced by its application. The knife, either the common scalpel, or that recommended by Mr. John Bell, is exceedingly difficult of being applied. I have witnessed that great and dexterous surgeon even foiled in its application.

When polypi, or sarcomatous tumours, grow in the antrum, they either force their way into the nares, up into the orbit, or out towards the cheek, or in all these directions. "More frequently," says Mr. John Bell, "the upper jaw-bone is destroyed; the tumour makes its way into the antrum; the whole upper jaw-bone becomes carious; the teeth drop from their places; and a fœtid matter distils from their sockets; and the patient dies, wasted by pain and hæmorrhagy."

parts of the mouth, from the lips to the fauces. This, therefore, comprehends the whole of the mouth, which is

All the cases that have come within my own knowledge (with the exception of one), wherein these sarcomatous tumours have been removed by laying open the antrum, have either returned, or terminated fatally. I am therefore decidedly of opinion, that unless we remove the whole diseased surface, which can only be done by taking away the entire superior maxillary bone, we merely tamper with the disease, put our patient to excruciating suffering, and ultimately to death. The inferior maxillary bone has now been nearly entirely removed for osteo-sarcoma with success, and I see no difficulty in accomplishing the same with one of the superior maxillary. We secure the common carotid artery for other tumours of the face, and for aneurism by anastomosis, and why not do it for so loathsome and fatal a disease as this? The steps or plan of the operation I would suggest for so fatal a disease, are, first to secure the trunk of the common carotid artery of the affected side; next to make an incision through the cheek, from the angle of the mouth backwards or iniad to the masseter muscle, carefully avoiding the parotid duct, then to divide the lining membrane of the mouth, and to separate the soft parts from the bone upwards to the floor of the orbit; thirdly, to detach the half of the velum palati from the palate-bone. Having thus divested the bone to be removed of its soft coverings, the mesial incisive tooth of the affected side is to be removed; then the one superior maxillary bone to be separated from the other, at the mystachial and longitudinal palatine sutures, and also the one palate-bone from the other, at the same palatine suture, as the latter bone also will require to be removed either by the forceps of Mr. Liston, or a saw; thirdly, the nasal process of the superior maxillary bone should be cut across with the forceps; fourthly, its malar process, where it joins the cheek-bone; fifthly, the eye with its muscles and cellular cushion being carefully held up by a spatula, the floor of the orbit is to be cleared of its soft connexions, and the superior maxillary bone separated from the lacrymal and ethmoid bones with a strong scalpel. The only objects now holding the diseased mass, are the pterygoid processes of the sphenoid bone with the pterygoid muscles. These bony processes will readily yield by depressing or shaking the anterior part of the bone, or they may be divided by the forceps, and the muscles cut with the knife. The bone, or bones, are frequently so soft in this disease, as to be easily cut with a knife or scissors. After the bone with its diseased tumour has been removed, the flap is to be carefully replaced, and the wound in the cheek held together by one or two stitches, adhesive plaster and bandage. In no other way do I see that this formidable disease can be eradicated, and those who have had the misery to witness the exposure of the antrum by laying open the cheek, and the alternate cutting and cauterizing, and afterwards the protracted treatment by the cautery, the inflammation, the offensive suppuration, and the hectic fever which supervene, and ultimately carry off the patient, will listen to any means which

bounded by the lips anteriorly, the velum palati F, *f*, in *Figs.* 1 of Plates III. IV. and V. of Part IX., by the cheeks laterally, by the palate superiorly, and by the tongue and inferior maxilla inferiorly. All this surface is lined with a soft vascular mucous membrane, immediately beneath which a profusion of small mucous glands are situated. This mucous membrane is an extension of the cutis vera, modified to perform this other function, and is also covered by the cuticle. The osseous structure of the mouth is formed by the superior maxillary, the palate, and the inferior maxillary bones, together with the teeth. In *Fig.* 3 of Plate IV., the lips are everted, and several of the glands, which are named labial, are represented by a removal of the mucous membrane; these are marked *u* in the upper lip, and *l* in the lower lip; and in the red part of the lip, they are so small as to appear delicate villi. The frenum of the upper lip is marked *f*, and that of the lower lip f, and each of them is an extension of the mucous membrane with some degree of muscularity, which adheres to the alveolar processes, between the mesial incisive teeth. The glands, which are situated between the mucous membrane and the buccinator muscles, are precisely of the same order and nature, and are named buccal. Those on the palate, both on the hard marked v,

hold out a prospect of a happier result. Two formidable objections exist against the present mode of operating; the one is the exposure of the mucous surface of the antrum to the cold external air, which invariably inflames it, and frequently involves the whole face and head in erysipelas; the other is the leaving the roots of the disease: whereas in the operation proposed, only the small ethmoidal and palatine cells may be exposed, but not necessarily so, and even if exposed, they are only so for a few seconds, as they are speedily covered by the flap. Again, instead of being compelled to lay open the wounded antrum day after day, we at once cover the cut surface, and endeavour to heal it by the first intention, but if not, by suppuration.

in *Fig.* 1 of Plate IV., and on the soft palate F, are termed palatine.

The gums investing the alveolar processes on each side, and surrounding the neck of each tooth, to which they adhere, are formed of a compact interstitial substance, thick in consistence, and very vascular. They run into, or unite with, the mucous membrane and the periosteum.

The tongue, which is the chief organ of tasting, consists of muscles, glands, nerves, blood-vessels, and absorbents. The muscles have been already described.

In *Fig.* 1 of Plate IV., the tongue is represented *in situ*, and is described as having a root, which is connected by muscles with the os hyoides X, and epiglottis Q, as delineated in *Fig.* 2 of Plate VII., in which Plate other views of this organ are also depicted; as having a body or middle part of the tongue, an apex or tip A, a dorsum or convex surface D, two sides or margins S, and an inferior surface, extending from its middle to the apex, which has the frænum linguæ extending along it from the apex to the symphysis of the inferior maxillary bone. The lining mucous membrane of the mouth, of which the frænum is a doubling, surrounds the whole tongue, and connects loosely its sides to the inferior maxillary bone, so that we have here also a continuation or extension of the integuments; the cuticle being exceedingly thin, the corpus mucosum very thick and moist, and the cutis vera affording origin to the papillæ. On the upper surface, or dorsum, is seen a longitudinal line, named linea mediana, or middle groove, marked D, in *Fig.* 3 of Plate VII., at the commencement of which, near the root, is perceived a foramen, marked *h*, in *Fig.* 1 of Plate IV., and in *Fig.* 3 of Plate VII., named the foramen cœcum of Morgagni,

and there are observed a multiplicity of small glandular papillæ, which are arranged into three series, according to their magnitude. The largest series are observed to extend on each side from the foramen cœcum *h*, so as to form nearly a right angle, the apex pointing to the root, and the part of the root of the tongue posterior to this aperture to be studded over with them. In *Fig.* 1 of Plate IV., this angle approaches to the acute, while in *Fig.* 3 of Plate VII., it approximates an obtuse angle. This largest series of glands are of a lenticular form, are situated in shallow fossulæ, and have distinct little foramina in the centre of their apices. It is these glands which form the walls of the little foramen cœcum, together with some excretory ducts. This order of papillæ are denominated lenticulares, maximæ, capitatæ, or villosæ. Besides these papillæ lenticulares at the root of the tongue, there are a number of mucous lacunæ, or follicles. The second series of papillæ, less in size than the preceding, but larger than the next, are observed scattered over the dorsum at irregular intervals or distances, between the largest series and the apex. These are somewhat of a cylindrical figure, and are named papillæ semi-lenticulares, mediæ, or fungiformes. The third or smallest series of papillæ are observed to be interspersed all over the dorsal surface, are very minute conical points, and are named papillæ minimæ, conicæ, or villosæ.

The nerves which supply the tongue, are the glosso-pharyngeal, the gustatory branches of the inferior maxillary, and the lingual nerves. The glosso-pharyngeal nerve, marked 13, in *Figs.* 3 and 4 of Plate VII., and also in Plate VII. of Part II., is described in page 57 of the latter Part. The gustatory or lingual branch of the inferior maxillary nerve, marked 32, in the same figures and plates, is also described in Part II. page 61.

The lingual nerve, marked 3, in the same figures and plates, is likewise described in Part II. page 58.

The arteries which supply the tongue are the lingual and facial, described in Part II. pages 42, 43, and 44; and are delineated in Plates VII. VIII. and IX., the lingual being marked *b*, and the facial *c*.

Fig. 2 of Plate VII. is a vertical section of the tongue, illustrating its delicate glandular and muscular structure.*

* The lips, the gums, the cheeks, and the tongue, from their glandular structure, are very subject to malignant ulceration, to warty excrescences, to various kinds of tumours, and to cancer. The lower lip is more subject to cancer and warty excrescences than the upper lip; and when either of these occur, it should be removed together with a portion of the lip, in order to have healthy surfaces to unite, and to prevent a return of the disease. The best form of incision is that of the letter v, the apex pointing towards the chin; the part to be removed should be held firm with the fingers of the left hand, and excised with a common scalpel, making an incision first on the one side and then on the other. A piece of pasteboard, shaped to the gums, and inserted between them and the lower lip, will enable the operator to proceed with more freedom. When the part is excised, the coronary arteries bleed freely at first, but are immediately stemmed by approximating the raw edges by common needles mounted on a small piece of wood like a pencil, thrust first through the one side of the lip, and then the other; and when the needle has transfixed both sides of the wound, its wooden handle is to be removed, by cutting the thread which mounted it, and a long thick ligature of four or six threads is to be twined round both ends of the needle, in the form of the figure of 8. From two to three needles are required, according to the extent of the wound, and when they have all been inserted, the ligature may be entwined several times, in order to keep the edges perfectly approximated. Small pieces of lint should be put between the ends of the needles and the skin, to prevent them pricking the skin. The same steps are pursued when operating for harelip. The needles should be withdrawn on the third or fourth day. The common sewing-needle, as it is much smaller in circumference, is a preferable instrument to the harelip-pin. When tumours are seated on the gums, they frequently affect the bone, so as to require a portion of the latter to be removed. This is easily accomplished on the lower jaw-bone, from its narrowness and more insulated nature, but with more difficulty on the upper maxillary bone. The inferior is oftener the seat of tumours than the superior maxillary bone. When any bleeding occurs, it must be stemmed by

Before describing the ear, I cannot but regret the very little attention which is usually paid by medical men to

the actual cautery. Few or more of the teeth commonly require to be extracted.

Tumours of the cheeks, warty excrescences, and cancerous ulcerations, are very common affections, and one and all of them should be early removed with the knife, as they lay the foundation of loathsome incurable diseases. I have witnessed the smallest warty excrescence imaginable involve the whole face in deep painful cancerous ulceration, rendering the life of the individual most miserable for two or three years, when a little boldness on the part of the surgeon, and fortitude on that of the patient, would have eradicated the evil in a few seconds. In all operations of the face, we have to endeavour to avoid the parotid duct. (See Plate X. of Part II., letter x.)

The tongue is subject to tumours, to enlargement from mercury, and to cancerous ulceration. When tumours are present, they may be either removed by ligature or the knife, and as the latter produces less inflammation and pain, it is to be preferred, while the bleeding is to be arrested by the actual cautery. When the tongue is so enlarged as to prevent deglutition, or to threaten suffocation, which sometimes happens from the imprudent use of mercury, and occasionally in small-pox, free longitudinal incisions should be made; and when mercury is the cause, the medicine should be discontinued, and the patient exposed to change of air, have purgative glysters administered, and blood abstracted from the arm, if the incisions in the tongue do not bleed enough. In cancerous ulceration, either the ulcerated surface, or the whole tongue, should be excised with the scalpel, and if the latter be adopted, the lingual arteries should be secured in the first place, where they run above or atlantad to the cornu of the os hyoides, taking care to avoid the lingual nerves, which lie superficially to the arteries. These vessels are imbedded in the hyo-glossi muscles, (See Part II. Plates VII. and VIII., artery marked *b*, nerve 3, muscle *i*). When these lingual arteries have been secured, the operator excises the diseased tongue, and if hemorrhage still takes place, it will arise most probably from the submental branch of the facial artery, seen also in Plates VII. and VIII. of Part II. This may be secured by ligature, but if found impracticable, the actual cautery must be used. There are several instances on record, of this cancerous ulceration having been cured simply by honey, others by arsenic, while others again by hemlock. I must confess that I have not had the delight to witness such happy results. I have at present a patient under my care with an extensive cancerous ulceration of both the tongue and palate, which has been only existing for five months, and which at first was confined solely to a small part of the tongue, and which might have been easily removed, whereas now it is past all hopes of being cured.

this most important organ; and the reason assigned by them for this neglect is, that its mechanism is extremely complicated and little known, its physiology, and consequently its diseases, still less so, and that even if these latter were known, nothing could be done for their removal, at least in diseases situated in the internal ear. All this may be very true, but instead of deterring us from the study, I think that it ought to be a most powerful incentive to its prosecution. Had physicians, from the complicated structure of the heart, been satisfied that the circulation of the blood should never be discovered, most assuredly it never would; for great discoveries in physiology are never made by chance, but only by patient and persevering investigation, can we ever expect to arrive at the truth. If such, then, is the case, and if we are so defective in the physiology of the ear, the importance of the subject should surely stimulate us to a minute and careful study of its anatomy, as the only means by which its physiology and its diseases can be thoroughly understood.

As yet, certainly, we are unacquainted with any means of cure, when the disease is situated in the internal ear, investigation, however, I am convinced, may do much even here; but although it never should, still the knowledge of the anatomy and physiology of the whole will enable us to determine, with greater certainty, the exact part of the organ which is diseased.

Having made these few introductory remarks, I shall proceed at once to describe what is known of its anatomy.

This organ of sense is divided into three portions, the external, the middle, and the internal; all the views of which are represented in Plates VIII. and IX. of this Part, *Fig.* 16 of Plate VIII. being an enlarged view of

Fig. 6 of the same Plate; *Figs.* 2, 4, 6, 8, 10, 13, and 17 of Plate IX. being enlarged views of *Figs.* 1, 3, 5, 7, 9, and 12 of Plate IX. The enlarged views are only marked.

The external portion, or external ear consists of cartilage, ligaments, muscles, sebaceous glands, adipose substance and integuments.

The cartilage, marked A, is named the pinna, and forms the greater part of this external portion, as seen in *Fig.* 16 of Plate IX., where the lower pendulous fatty substance has been removed, which is represented in *Figs.* 1, 2, 3, 4, and 5 of Plate VIII., marked B, and termed the lobulus.

The pinna has several elevations and depressions, which are better understood in the perfect ear than in *Fig.* 16 of Plate IX., where nothing but this cartilage is present. The elevations are the helix, marked *a*, in *Figs.* 1, 2, 3, 4, and 5 of Plate VIII., and in *Fig.* 16 of Plate IX. the antihelix c, in *Figs.* 1, 2, and 5 of Plate VIII., and in *Fig.* 16 of Plate IX., the tragus *e*, and the antitragus *o*, represented in the same figures.

The helix, letters *a*, in *Figs.* 1, 2, 3, 4, and 5 of Plate VIII., and in *Fig.* 16 of Plate IX., forms the boundary of the pinna, running in an arched form, and being turned over, or partially overlapping the general pinna; it begins at the lobulus B, and runs round from behind forwards, descending into the cavity, named the concha C, which it partially divides into two. Within the concavity of this helix, there is naturally formed a groove or fossa, named fossa innominata, marked with the letters *i*, in *Figs.* 1, 2, and 5 of Plate VIII., and in *Fig.* 16 of Plate IX., and which also begins at the lobulus, and runs around, descending into the concha C.

Within the circle of the helix, the antihelix, marked c, is situated, which forms the brim or margin of the concha C, and commences near the antitragus *o*, ascending and dividing into two crura, marked *c*, *c*, in its course onwards to the fossa innominata *i*; the lower crus continuing to form the margin of the concha C. Between the crura *c*, *c*, of the antihelix, there is formed a depression, marked *n*, named fossa navicularis, or scapha, which communicates with the fossa innominata.

The tragus marked *e*, is that triangular looking portion of the pinna, situated anterior or glabellad to the concha C, which, from being studded with bristly hairs in advanced life, has got its appellation. It is partially separated from the helix by a fissure, marked x, and forms the exterior commencement of the cartilaginous portion of the auditory tube.

The antitragus *o*, is the triangular portion of the cartilaginous pinna, opposed to the tragus *e*, and is immediately above the lobulus B, forming the inferior margin of the concha C. A fissure, marked w, in *Fig.* 16 of Plate IX., is observed to separate this from the helix *a*.

The concha, marked C, in *Figs.* 1, 2, and 5 of Plate VIII., and in *Fig.* 16 of Plate IX., is the large irregularly shaped cavity, bounded by the tragus *e* anteriorly, the antitragus *o* inferiorly, the antihelix c, with its inferior crus *c*, posteriorly and superiorly, and also by the termination of the helix *a*. The floor of this cup is formed by the general cartilage, as observed in *Fig.* 4 of Plate VIII., which is an outer or posterior view of the external ear. The concha C leads directly to the meatus auditorius externus *m*, or the cartilaginous portion of the tube, which tubular portion, marked *p*, in *Fig.* 5 of Plate VIII., is laid open to show its extent, from the external aperture down to the

membrana tympani *r*. This cartilaginous portion *p*, is seen to be of some length, to have an oblique direction downwards and forwards, or basilad and glabellad, and to be fixed on the scabrous auditory process of the temporal bone, the osseous continuation of which is here also laid open downwards to the membrana tympani. This tubular portion of the ear has a number of ceruminous glands situated within it, and is also studded with delicate hairs.*

On looking at the outer or posterior aspect of the pinna, we observe several fossæ, as delineated in *Fig.* 4 of Plate VIII., which are evidently the depressions formed by the elevations on the anterior aspect. The fissures between the portions of the pinna are, one between the helix *a*, and tragus *e*, as delineated in *Fig.* 16 of Plate IX., marked T, another between the helix *a*, and the antitragus *o*, marked W, and a third at the base of the tragus, marked X. Across these fissures there extend remarkably delicate ligaments, so delicate that they are scarcely capable of representation.

The muscles which operate on this cartilage are very numerous.

The levator vel attollens aurem,† delineated in Plate

* Its oblique direction and length should be well considered with regard to syringing the ear, when clogged up with hardened wax in a state of suppuration, and also when affected with polypus. When the last affection is present, the tumour should be laid hold of with a small hook, and gently elongated, and then a pair of delicate blunt pointed scissors are to be glided along the tumour to its pedicle or root, with which it is to be divided. Little or no bleeding follows, and to prevent or stunt the growth of the polypus, it should be touched with the nitrate of silver, for several days successively.

† Syn. Auriculæ primus : Primus propriorum auriculæ : Portio musculi frontalis supra crotaphitam ad aurem producti : Attollens auriculæ : Attollens auriculam : Superior auriculæ : Le premier de l'oreille : Le premier et le second mitoyen : Le muscle supérieur de l'oreille : Temporo-auriculaire : Temporo-conchinien.

X. of Part II., marked r; also in *Figs.* 1 and 2 of Plate VIII. of Part IX., is situated on the lateral aspect of the cranium, immediately beneath the integuments, with which it is very liable to be lifted up when displaying it. This muscle consists of a delicate assemblage of scattered muscular fibres, which originate from the expansive tendon of the occipito-frontalis muscle q, and descend to be inserted in the upper or coronal aspect of the back or dorsum of the cartilage, which forms the fossa navicularis, the fibres ascending upwards to the dorsum of the helix. The function of this muscle is to elevate the cartilage or pinna, upwards and forwards, or coronad and glabellad; and also to operate on the fossa navicularis.

The anterior auris muscle,* marked D, in *Figs.* 1 and 2 of Plate VIII. of Part IX., situated between the cheek-bone and the external cartilage of the ear, derives its origin from the zygomatic process W of the temporal bone, and after a short course, is inserted in a small eminence, marked *d*, in *Fig.* 16 of Plate IX., on the dorsum, or back part of the helix. Its function is to pull forwards or glabellad, and a little upwards or coronad, the external cartilage of the ear, and to widen or expand the fossa innominata.

The retrahens vel retrahentes auris muscle,† marked with the letters R, in *Fig.* 3 of Plate VIII., situated behind the external cartilage of the ear, consists of two or more fleshy slips, which originate from the mastoid pro-

* Syn. Auriculæ musculus anterior : L'antérieur de l'oreille : Musculus novus conchæ proprius : Prior auriculæ : Zigomato-oriculaire : Zigomato-conchinien.

† Syn. Secundus auriculæ : Secundus propriorum auriculæ : Proprius auris externæ : Le second de l'oreille : Retrahens auriculam : Posteriores auriculæ : Posteriores auriculæ et postici corrugatores : Tres retrahentes auriculæ : Le postérieur de l'oreille : Mastoïdo-oriculaire : Mastoïdo-conchinien.

cess of the temporal bone, superficially to the tendinous insertion of the sterno-cleido-mastoideus, and the origin of the posterior fleshy belly of the occipito-frontalis, and extend nearly horizontally, converging to a point, to be inserted in the dorsum of the cartilage forming the concha. Its function is to pull backwards or iniad the external cartilage, and to widen or expand the concha.

The helicis major muscle,* marked H, in *Fig.* 2 of Plate VIII. of Part IX., situated on the convex margin of the helix, where it runs round and down into the concha, is an extremely small muscle, which derives its origin from the helix within the concha, and ascends on its acute convex edge, nearly to its highest aspect, where it is lost. Its function is to depress that portion of the helix, in which it is inserted, and by this to dilate the fossa innominata. It may also elevate that portion of the helix, from which it arises, and hence also dilate the fossa innominata.

The helicis minor muscle,† marked *h*, in *Fig.* 2 of Plate VIII. of Part IX., is situated nearer the antihelix than the major, and derives its origin from nearly the acute margin of the helix within the concha, and ascends a shorter way along the flat exterior surface of the helix, on which its fibres are lost. Its function is to assist the helicis major.

The tragicus muscle,‡ marked T, in *Fig.* 2 of Plate VIII. of Part IX., is situated on the anterior and outer surface of the tragus *e*, from the root of which it arises, and ascends to be inserted in its apex. Its function is to

* Syn. Helicis musculus: Major helicis: Helix.

† Syn. Fibræ musculares in plana helicis facie: Minor helicis: Concho-helix.

‡ Syn. Musculus tragi: Concho-tragique.

pull the tragus forwards, and to widen or expand the concha C in that direction.

The antitragicus muscle,* marked *t*, in *Fig.* 2 of Plate VIII. of Part IX., situated on the antitragus *o*, derives its origin from the commencement of the antihelix c, and runs along the antitragus *o* to its apex. Its function is to pull the antitragus backwards or iniad, so as to widen or expand the concha C, in that direction. It may also pull the antihelix to the antitragus, so as to raise up that portion of the margin of the concha.

The transversus auris muscle,† marked υ, in *Fig.* 4 of Plate VIII., situated on the dorsum of the external cartilage of the ear, is a scattered assemblage of muscular fibres, deriving their origin from the superior or coronal aspect of that portion which forms the concha, and passing across the fossa made by the antihelix, they are inserted in the dorsum of the helix. Its function is to pull backwards and downwards the helix and antihelix, and thus to dilate and expand the fossa innominata and navicularis. It will also raise the acute margin of the helix, so as to open the fossa innominata.

This external cartilage, with its muscles, has a number of sebaceous glands imbedded in the integuments investing it, the secretion of which is best exemplified in the fossa innominata, where from inattention it frequently becomes vitiated.

After the description of the external, I shall proceed to that of the middle portion of the ear, which consists of the tympanum, mastoid cells, and Eustachian tube, the tympanic cavity being represented in *Figs.* 6, 9, and

* Syn. Musculus antitragi: Antheli-tragique.

† Syn. Sunt fibræ transversæ in gibbo auriculæ: Fibræ, quæ in convexa conchæ parte: Transversus auriculæ: Concho-anthelix.

16 of Plate VIII., marked t, the mastoid cells m, and the Eustachian tube Z, in *Fig.* 5 of the same Plate. *Fig.* 16 is an enlarged view of *Fig.* 6.

The tympanic cavity t, *Figs.* 6 and 16 of Plate VIII., of an irregular circular figure, is bounded outwardly or peripherad by the membrana tympani *r*, *Fig.* 5 of Plate VIII., and in *Figs.* 1, 2, 3, and 4 of Plate IX. It is bounded inwards or centrad by an osseous partition between it and the vestibular cavity, which is seen in *Fig.* 6 and 16 of Plate VIII., having the foramen ovale o, and the foramen rotundum r, formed in it, which, in the recent state, are filled up by the extension of delicate membranes, and are then named fenestræ; it is bounded on its anterior or glabello-basilar aspect, with bone, but having a free communication with the posterior aperture of the nares and pharynx, through the medium of the Eustachian tube z, in *Fig.* 5 of Plate VIII.; and it is bounded on its posterior or inial aspect also by bone, having a free communication with the mastoid cells m, *Fig.* 6 of Plate VIII. This tympanic cavity is invested with a delicate mucous membrane, which may be said to be a continuation of that of the nares and pharynx, extending along the Eustachian tube, and in this cavity are contained the ossicula auditus, as represented in *Fig.* 7 of Plate VIII., and in *Figs.* 1, 2, 3, 4, 5, and 6 of Plate IX.

The membrana tympani *r*, *Figs.* 5 and 8 of Plate VIII., and *Figs.* 1, 2, 3, and 4 of Plate IX., situated obliquely at the bottom of the auditory tube, and forming the outer or peripheral wall of the tympanic cavity, adheres to a delicate projecting ring of the bone, of an oval circular shape, marked *a*, in *Fig.* 8 of Plate VIII., and consists of two laminæ, or membranes, the one being an extension of the cuticle from the auditory tube, the other an extension of the mucous membrane or perios-

teum, which invests the tympanic cavity. In early life it is beautifully radiated and very vascular, as represented in *Fig.* 8 of Plate VIII.; and in the fetal condition, there is an adventitious membrane exterior to the membrana tympani, named membrana mucosa, which on investigation is found to consist of two layers united at their margins, so as to constitute a membranous pouch, containing a whitish coloured flaky fluid. To the membrana tympani, the handle 5 of the malleus is attached. *Figs.* 8 and 7 of Plate VIII. are interior or central views, and therefore the handle is marked, while *Fig.* 5 of Plate VIII., and *Figs.* 1, 2, 3, and 4 of Plate IX. are exterior or peripheral views of the membrane, where the handle of the bone only shines through, and is therefore not marked. The other long process seen running parallel with the handle of the malleus, in some of these figures, is the long crus of the incus, which does not adhere to the membrane, and is consequently more faintly drawn.*

The anterior or glabello-basilar wall is extremely short or low, and has the Eustachian tube z opening into it. This tube is partly osseous and partly cartilaginous, as best illustrated in *Figs.* 1 and 2 of Plate IX., the small roman z, being placed on the cartilaginous portion, while the roman

* The situation, connexion, and obliquity of the membrana tympani, require to be considered by the operator, as it is sometimes requisite to pierce it for deafness. This can only be requisite when the membrane is exceedingly thickened from disease, or the Eustachian tube obstructed by disease, or when both occur. This little delicate operation may be performed, either simply with a stilet, curved to the shape of the auditory tube, or with a trocar and canula of the same shape; the latter is the preferable instrument, and should be cautiously introduced, having the trocar sheathed in the canula, till the latter meets with resistance from the membrane, which is known by the yielding springing resistance felt, and then the trocar is to be pushed along the canula to puncture the membrane. The loud sound felt by the patient informs the operator that he has succeeded.

capital Z, is placed on the osseous, the outer wall of which is necessarily broken up. The same roman capital is used in the mere osseous preparations of *Figs.* 6 and 7 of Plate VIII. This tube begins small in the tympanum, and gradually swells in diameter, till its termination at the posterior aperture of the nares, as seen in *Fig.* 1 of Plate V.; and in this course is attached to the basilar surface of the petrous portion of the temporal bone. The cartilaginous portion is very delicate in some points; and the whole tube is lined with a mucous membrane, which may be said to be the continuation of that of the nares and pharynx.* In the osseous state, there is another tube opening into the tympanic cavity, viz. the semi-osseous canal of the tensor tympani muscle, marked 1**, in *Figs.* 6 and 16. This tube is also indicated by the bristle marked 1, in *Fig.* 6 of Plate VIII., and is distinguished from that of the Eustachian tube, by being a degree smaller in calibre, and more centrad and coronad, or internal. On looking along the petrous portion into the tympanum, at these two canals, we observe only a delicate osseous lamina, partially separating them, for they communicate superiorly and laterally, or corono-laterad, the bone forming one arch over the two. In the recent state, the tensor tympani muscle, marked q, in *Figs.* 1 and 2 of Plate IX., at once indicates it.

The posterior wall of this tympanic cavity is equally as short or low as the anterior, and has a large aperture,

* When the Eustachian tube is inflamed, it should be treated by inhaling the vapour of hot water, or by inserting a tube along the nares, into its aperture in the pharynx, and having fitted a syringe to this tube, by injecting warm water into the Eustachian trumpet. The same means should be employed when this tube is obstructed; or a probe may be introduced from the nares along it.

which leads directly to the mastoid cells m. In *Fig.* 6 of Plate VIII., the small osseous bridge, which forms this aperture, is left, while in *Fig.* 7 of the same Plate, it is removed, the mastoid cells and tympanic cavity being thrown into one. These cells vary very much in different crania, some being large and few in number, while others are small and numerous: the latter of which is the case in *Fig.* 1 of Plate IX. They are lined with the mucous membrane common to the tympanic cavity and Eustachian tube.*

In the osseous state, there are many objects on the central or inner wall, or bottom of the tympanic cavity; the foramen ovale marked o, in *Fig.* 6 and 16 of Plate VIII., situated nearly in the centre, leads directly into the vestibular cavity; but in the recent state it is filled up with a membrane, an extension of the vascular periosteum, or mucous membrane of the cavity, and to the tympanic aspect of this membrane, now named fenestra, the base *w*, of the stapes one of the ossicula auditus is fixed. This bone is represented *in situ*, in *Fig.* 9 of Plate VIII., and in *Figs.* 9 and 10 of Plate IX.

The foramen rotundum r, which leads from the tympanum into the tympanic scala of the cochlea, is situated immediately beneath or basilad, and nearer the entrance to the mastoid cells, as represented in *Fig.* 6 and 16 of Plate VIII., and in *Figs.* 9, 10, 12, and 13 of Plate IX. This, like the foramen ovale, has an extension of the vascular periosteum, or mucous membrane of the tympanum, stretched to its margin, so as to form a fenestra.

Close to the inial or posterior elliptical margin of the fora-

* The mucous membrane of the mastoid cells is subject to inflammation and suppuration, particularly in early life; and when an abscess is ascertained, the matter must be evacuated, by making a crucial incision over the mastoid process, applying a small trephine, and giving exit to the matter.

men ovale, and nearer the mastoid cells than the latter, the osseous hollow pyramid, marked p, in *Figs.* 6, 9, and 16 of Plate VIII., and in *Figs.* 7, 8, 9, and 10 of Plate IX. is situated. This gives exit to the stapedius muscle, marked s, in *Figs.* 9 and 10 of Plate IX., and to the chorda tympani nerve marked 33, in *Figs.* 7, 8, 5, and 6 of Plate IX. In *Fig.* 6 of Plate VIII. a bristle, marked 2, is inserted in the Fallopian aqueduct A, and brought out at the osseous pyramid p, to show the manner in which the facial nerve runs this length, and gives origin to the chorda tympani twig. This Fallopian aqueduct, or canal A, in its course exterior to the central wall of the tympanum, makes a slight elevation immediately above, or coronad of the foramen ovale, and as this canal lodges the facial nerve, its course and manner of elevation are better understood by comparing *Figs.* 6 and 16 of Plate VIII. with *Figs.* 9 and 10 of Plate IX., where the facial nerve is marked 44. In *Fig.* 16 of Plate VIII., a bristle marked 2, is inserted in this aqueduct, at the foramen stylo-mastoideum, and two dotted lines are drawn in continuation; the one marked 33, proceeds to the pyramid p, while the other, marked A, indicates the course of the facial nerve. Precisely above, or coronad and somewhat iniad, near the beginning of the passage to the mastoid cells, a small protuberance marked *c*, in *Fig.* 16 of Plate VIII., is seen, which is made by the external or horizontal semicircular canal. This elevation will be better understood by comparing *Fig.* 16 of Plate VIII., with *Figs.* 9 and 10 of Plate IX., where *c* indicates the canal.

Between the foramen ovale and rotundum, there is an elevation observable, named the promontory, marked *a*, in *Fig.* 16 of Plate VIII., which is caused by the vestibular cavity and the commencement of the cochlea.

This elevation will be more easily comprehended by comparing this figure of Plate VIII. with *Fig.* 12 of Plate IX., where C indicates the cochlea, and V the vestibule.

Within this tympanic cavity are contained the ossicula auditus, the malleus, the incus, and the stapes. These are represented *in situ*, in *Figs.* 7 and 8 of Plate VIII., and in *Figs.* 1, 2, 3, 4, 5, 6, and 15 of Plate IX., and separately in Plate VIII., where *Figs.* 11 and 12 indicate the malleus, 13 and 14 the incus, and 15 the stapes.

The malleus, (*Figs.* 11 and 12 of Plate VIII., *Fig.* 11 being an internal or central view, and 12 an external or peripheral view, and both being bones belonging to the right side), is situated in the tympanic cavity, having some faint resemblance to a hammer, and is described as having a head, marked 1*, a cervix 2, a long slender process 3, a short process 4, and a handle 5. The head has a double articulating surface, with a slight depression or groove dividing it, by which it is joined to the body 6* of the incus. In the cervix, near the short process, the laxator tympani minor muscle, marked 1, in *Figs.* 3 and 4 of Plate IX., is inserted. The long slender process 3, rests in the fissure of Glasserus, and in it is inserted the laxator tympani major muscle, marked L in *Figs.* 1 and 2 of Plate IX. In the handle of the bone, near this long slender process, is inserted the tensor tympani muscle, marked q, in *Figs.* 1, 2, 3, 4, and 15 of Plate IX. The short process itself adheres to the membrana tympani. The handle 5 of the malleus, adheres to the membrana tympani *r*, as represented in *Fig.* 8 of Plate VIII., and in *Figs.* 1, 2, 3, 4, and 16 of Plate IX. The malleus is hollow like the long cylindrical bones.

The incus, *Figs.* 13 and 14 of Plate VIII., the former being an internal or central view, and the latter, or 14,

an external or peripheral view, and belonging to the right ear, is situated within the tympanic cavity, and consists of a body 6*, a long crus 8, and a short crus 7*. The body has an articular surface to correspond with that of the head of the malleus, with which it is connected by a delicate capsular ligament. The short crus 7*, rests in the aperture leading to the mastoid cells, as represented in *Figs*. 7 and 8 of Plate VIII., and in *Figs*. 3, 4, 5, 6, and 15 of Plate IX., and its long crus 8 runs somewhat parallel to the handle of the malleus, downwards and inwards, or basilad and centrad, in the tympanic cavity, as delineated in *Figs*. 3, 4, 5, and 6 of Plate IX., its extremity giving rest to the apex 17 of the stapes, as seen in *Fig*. 8 of Plate VIII. This end or small projection of the long crus of the incus, is considered by some anatomists as a distinct bone, and named os orbiculare. The incus is hollow internally.

The stapes, *Fig*. 15 in Plate VIII., situated in the cavity of the tympanum, consists of a base, marked *w*, which corresponds in shape with the foramen ovale, the upper or coronal edge or margin being semicircular, while the lower or basilar is nearly straight, and is attached to the fenestra ovalis, as represented in *Fig*. 9 of Plate VIII., and in *Figs*. 9 and 10 of Plate IX.; it consists of two crura, a long one 10, looking backwards to the mastoid cells, and more curved than the short one 9, which looks forwards to the Eustachian tube. Both the crura and the base are slightly grooved, to receive a delicate membrane, named the membrane of the stapes, which is attached within their arch, as represented in *Fig*. 15 of Plate VIII., marked 18. This bone also consists of an apex or head 17, resting on the extremity of the long crus of the incus, as depicted in *Fig*. 8 of Plate VIII. To either the long posterior crus or the apex, the stapedius muscle s, is at-

tached, as delineated in *Figs.* 9 and 10 of Plate IX. The manner in which these ossicula auditus are joined or articulated to each other, is best represented in *Fig.* 8 of Plate VIII., this being a drawing of the fetal temporal bone.*

To enable these little bones to perform their motions, there are four muscles attached to them, viz. the tensor tympani, the laxator tympani major, the laxator tympani minor, and the stapedius.

The tensor tympani muscle,† marked q, in *Figs.* 1, 2, 3, 4, 7, 8, and 15 of Plate IX., situated partly without and partly within the tympanic cavity, derives a broad and fleshy origin from the styloid process of the sphenoid bone, where the spinous artery of the dura mater enters the superior border of the cartilaginous extremity of the Eustachian tube, and runs backwards or iniad along the osseous portion of the tube, and in its own semi-osseous canal, where becoming tendinous, it enters the tympanic cavity running backwards to be inserted internally or centrad in the handle of the malleus, and on the aspect opposite to the membrana tympani, near its long process. When the muscle leaves its semi-osseous canal, marked 1**, in *Figs.* 1 and 2 of Plate IX., it makes a turn backwards into the tympanum: its course and insertion are distinctly seen in *Figs.* 7 and 8 of Plate IX., where the malleus and incus are thrown outwards and downwards, or peripherad and basilad. Its function is to pull the

* The ossicula auditus are occasionally discharged in suppuration of the mucous membrane lining the tympanic cavity, accompanied with ulceration of the membrana tympani.

† Syn. Musculus ossiculi malleo comparati : Musculus malleum ad incudem movens : Auris internæ secundus, qui ab osse cuneiformi prognatus : Alter internus et in concha latitans : Musculus internus auris : Internus mallei : Le second de ceux qui apartiennent au marteau, et l'externe : Musculus majoris processus : Le monogastrique : Le muscle interne de marteau : Salpingo-malléen : Auris membranarum tensor.

malleus and membrana tympani inwards or centrad, and thus render its external or peripheral surface concave. It pushes the stapes against the membrana fenestræ ovalis, diminishes the vestibular cavity, and thus tenses all the membranes of the labyrinth.

The laxator tympani major* muscle, marked L, in *Figs.* 1, 2, and 16 of Plate IX., situated partly without and partly within the tympanic cavity, derives a fleshy origin from the styloid process of the sphenoid bone, and runs backwards, and becoming tendinous it enters the tympanum at the fissure of Glasserus, to be inserted in the long slender process of the malleus, where the latter rests in this fissure. Its function is to pull the handle of the malleus forwards upwards and inwards, or glabellad coronad and centrad, and by this to tense the membrana tympani in these directions; and also to tense the other membranes inwards and forwards.

The laxator tympani minor† muscle, marked l, in *Figs.* 3 and 4 of Plate IX., situated at the superior or coronal aspect of the membrana tympani, lying in a fine duplicature of the periosteum of the tympanum, derives its origin from the superior, posterior, or corono-inial margin of the meatus auditorius externus, where the membrana tympani adheres to it, and descends forwards and outwards, or glabellad and peripherad, to be inserted in the neck of the malleus near its short process. Its function is to pull the handle of the malleus backwards, upwards, and inwards, or iniad, coronad, and centrad, and thus to tense the

* Syn. Auris internæ externus: Externus mallei: Externus auris vel laxator externus: Musculus processus minoris mallei: Le muscle externe ou superieur du marteau: Acoustico-malléen: Auris membranarum in anteriora et interiora tendens.

† Syn. Auris membranarum in posteriora et interiora tendens.

membrana tympani in these directions, and also to tense all the membranes backwards and inwards, or iniad and centrad.

The stapedius muscle,* marked s, in *Figs.* 9 and 10 of Plate IX., situated in the posterior aspect of the tympanic cavity, arises by two origins, the one within the Fallopian aqueduct, the other from the hollow osseous pyramid of the tympanum; these uniting, run forwards and inwards, or glabellad and centrad, to be inserted in the posterior or inial aspect of the apex or head of the stapes, and sometimes in the posterior crus of this bone. Its function is to pull the apex or head of the stapes outwards and backwards, or peripherad and iniad, and thus to relax the membrana tympani, and membrana fenestræ ovalis, and also to enlarge the vestibular cavity, and relax all the membranes of the labyrinth.

I shall now proceed to the description of the proper internal portion of the ear, or what is named the labyrinth, which is divided into the vestibulum, the three semicircular canals, and the cochlea. These three portions are represented *in situ*, in *Fig.* 7 of Plate VIII., and in connexion with each other, but removed from the temporal bone in *Fig.* 10 of the same Plate; and also in *Figs.* 12, 13, and 15 of Plate IX., the cochlea being marked C, the vestibule v, and the three semicircular canals, *c*, *p*, *o*.

We observe in *Fig.* 6 of Plate VIII., in the dry osseous state, when the stapes is removed, that the foramen ovale o leads directly into the vestibular cavity. The same is represented in *Fig.* 10 of the same Plate, the let-

* Syn. Le muscle de l'étrier: Musculus stapidis: Stapedis musculus: Stapidæus vel musculus stapedis: Le second muscle de l'oreille interne que nous appellons petit: Pyramido-stapidien: Auris membranarum laxator.

ter v indicating the foramen ovale, which leads directly into the vestibule. When the stapes is left *in situ*, its base *w* shuts up this foramen, as represented in *Fig*. 9 of Plate VIII., and in *Figs*. 9 and 10 of Plate IX. When the partition between the tympanic and vestibular cavities, in which this foramen ovale is situated, is removed, and the vestibule laid open, as in *Figs*. 12, 13, and 17 of Plate IX., marked v, it is observed to be somewhat of an oval circular form, having several foramina opening into it. In these figures, particularly 13 and 17 of Plate IX., it is larger than in nature. This cavity is invested with its periosteum, within which is found a delicate pulpy membrane, a watery fluid, and the expansion of part of the auditory nerve. At the posterior or central wall, this nerve enters by a number of delicate filaments, which makes the dried bone have a sieve-like appearance, when held between the eye and the light, and therefore named macula cribrosa. The internal auditory foramen, by which the nerve enters, is immediately behind. This macula cribrosa is subdivided into two surfaces, which are named from their shape, cavitas semi-ovalis, marked *s*, in *Fig*. 17 of Plate IX., and cavitas hemispherica, marked *h*, in the same figure. A third cavitas is described by authors, named sulciformis, marked *f*, in the same figure, which is merely the commencement of the aqueduct of the vestibule, that is situated near the tubulus osseus communis, marked *p-o*, of the superior and posterior semicircular canals. This aqueduct of the vestibule proceeds through the bone, and opens about half an inch behind or iniad to the foramen auditorium internum in the adult, in a small pouch between the dura mater and the bone. The external aperture is marked K, in *Fig*. 14 of Plate IX. Contiguous to the cavitas semiovalis *s*, a small projection is seen, marked G, which is named the osseous pyramid of the vestibule. The cochlea

communicates with the anterior aspect of the vestibule, by a large aperture, as represented in *Figs.* 12 and 13 of Plate IX., marked *w**, and the three semicircular canals open or terminate by five apertures in the posterior aspect of the vestibule, as delineated in the same figures.

The three semicircular canals, marked *p*, *c*, and *o*, in *Figs.* 7 and 10 of Plate VIII., and in *Figs.* 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, and 15 of Plate IX., are situated posteriorly or iniad to the vestibule, each forming nearly three-fourths of a circle, being remarkably equal in their circumference, having a gently waving or undulating appearance, and so placed as to catch every direction of sound; thus one of them, marked *p*, is placed superiorly or vertically, or across the petrous portion, its convexity constituting the most elevated point of this part of the bone, its edge being turned forwards, and is termed the superior or vertical canal; the one aperture is more expanded than the other, which expansion or dilatation is named the ampulla, marked P, in *Fig.* 13 of Plate IX.; its other extremity, or aperture, joins or communicates with one of the ends of the posterior or oblique canal *o*, forming the tubulus osseus communis, marked *p-o*, in the same figure. Another of these semicircular canals *o*, is placed perpendicularly oblique, so that its side is turned forwards, its one extremity joining the vertical canal *p* to form the tubulus osseus communis *p-o*, its other extremity being dilated to form its ampulla, marked O, in *Fig.* 13 of Plate IX.: this is styled the oblique or internal canal. The third canal *c*, is placed horizontally, and is named the horizontal or external, having its ampulla at its superior aperture, marked C, in *Fig.* 13 of Plate IX. This last is the least of the three semicircular canals. These semicircular canals are invested in the fresh state with their periosteum, within which is contained the same

watery fluid as in the vestibule, and a delicate pulpy membrane, on which is expanded part of the auditory nerve.

The cochlea, marked C, in *Figs.* 7 and 10 of Plate VIII., and in *Figs.* 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 15 of Plate IX., is situated anteriorly or glabellad to the vestibule v, having its base looking inwardly or centrad towards the foramen auditorium internum, which it touches, and its apex looking outwardly or peripherad towards the tympanum and Eustachian tube; it is a spiral volute of two gyri, or turns, and a half, formed by the petrous portion, and divided partially by a delicate semi-osseous lamina, that winds round a central pillar, as satisfactorily illustrated in *Fig.* 11 of Plate IX. In this figure, which is a magnified view, the letters C indicate the petrous portion forming the walls of this elegant little figure, which are observed to run towards the modiolus, or central pillar *m*, so as to constitute the osseous septum, which consists of two laminæ, and divides the gyri; those having an asterisk * after the C, point particularly to this septum. The letters *m* point out the central pillar, or modiolus, which extends from the base upwards to the middle of the second turn, and which consists of two thin laminæ, or plates, that are hollow and foraminular, in order to allow the delicate threads of the auditory nerve to pass through. The hollow tube of the modiolus is named the tractus foraminulosus. Around this modiolus *m*, winds the delicate lamina spiralis, or septum scalarum *l*, which commences at the base, and terminates at the apex, in a small hook-like point, named the hamulus laminæ spiralis *g*. This lamina, which is foraminular, and consists of two plates, divides the gyri, or turns, into two open tubes or scalæ, and therefore does not touch the sides or walls C, of the cochlea, in the dried state;

but in the fresh state this partition is completed, by an extension of a delicate pulpy membrane from this lamina *l*, to the walls C of the cochlea, which is termed the zona mollis, and upon it, as also the lamina spiralis, the delicate threads of the auditory nerve are expanded. These two tubes, or scalæ, the one of which commences at the foramen rotundum r, in *Fig*. 12 of Plate IX., is named the external, or tympanic; the other, termed the internal or vestibular, begins in the vestibule, as delineated in *Fig*. 13, marked *w**, and they both wind round the modiolus *m*, to the apex, where they communicate freely, through the medium of a small aperture under the hamulus *g*, styled the canalis scalarum communis, marked *h*. These scalæ are therefore of a conical shape. At the apex there is a small cavity, marked *i*, in *Fig*. 11, named the infundibulum, the base of which is formed by part of the walls of the cochlea, marked *a*, and termed the cupola, while the apex points to the apex of the modiolus. The foramen rotundum, like the ovale, has a membrane stretched across it, converting it into a fenestra. The cochlea is invested with its periosteum, and a delicate pulpy membrane. Within the tympanic scala, at its commencement, and near the foramen rotundum, a small fossa is perceived, named the sinus fenestræ rotundæ, marked t, in *Fig*. 17 of Plate IX., at the bottom of which is the internal opening of the aqueduct of the cochlea, which descends and opens within the cranium, immediately below the meatus auditorius internus. The external aperture is marked *k*, in *Fig*. 14 of Plate IX.

The internal auditory foramen, or meatus, is delineated in *Fig*. 14 of Plate IX., marked M, m, *b*, being a representation of it in the temporal bone of the right side. At the bottom of this meatus, an osseous ridge *b*, is observed to divide it in two portions or recesses. The

inferior M, when viewed between the eye and the light, is minutely cribriform, and is opposite the base of the cochlea and the vestibule, or actually forms the floor or base of the cochlea, and nearly the whole of the interior or posterior or central wall of the vestibule; here the auditory nerve enters, by dividing into numerous delicate and minute soft threads, the anterior fasciculus of which are distributed throughout the cochlea, by piercing the anterior or glabellar portion of the cribriform lamina, at the bottom of the meatus auditorius internus, and by ascending the hollow modiolus, or tractus foraminulosus, onwards to the pulpy membrane investing the infundibulum, and in this course piercing the minute foraminular structure, or canaliculi of the modiolus, and between the laminæ constituting the osseous septum, which divides the gyri, and also those of the lamina spiralis, to be distributed over the pulpy membrane investing the lamina spiralis, the cribriform structure of which enables them to be extensively distributed both over it and the zona mollis, and also over all the pulpy membrane investing the sides or walls of the scalæ. Plexiform expansions are formed over the lamina spiralis, and zona mollis. A delicate branch of this fasciculus proceeds laterally from the cochlea to the vestibule. Other threads of this nerve enter the vestibule through the foraminular plate, or maculæ cribrosæ of the cavitas semiovalis and sulciformis, to be distributed on the pulpy membranes of the vestibule and the three semicircular canals. These last threads constitute the posterior fasciculus which divides into three branches; the largest presents a gangliform swelling, pierces the macula cribrosa of the cavitas semiovalis, and supplies the posterior or central portion of the pulpy membrane investing the vestibule, which is named the alveus communis of the semicircular canals;

this portion also supplies the vertical and horizontal semicircular canals. The middle portion pierces the macula cribrosa of the cavitas hemispherica, to be distributed on the pulpy membrane of the vestibule. The smallest branch pierces the posterior part of the internal auditory foramen, and is distributed on the pulpy membrane investing the oblique canal. The origin of the auditory nerve is described in page 33 of Part VIII.

I have here deeply to regret the impossibility of procuring an ear fresh enough to give a representation of the beautiful distribution of the auditory nerve.

The superior recess m of the internal auditory meatus, has a distinct round foramen, which is the commencement of the Fallopian aqueduct, that gives passage to the facial nerve. Part of the course of this aqueduct is represented in *Fig.* 12 of Part IX., marked A, and another part in *Figs.* 6 and 16 of Plate VIII., also marked A, and in both of which is inserted a bristle marked 2. The facial nerve itself, however, is displayed in *Figs.* 9, 10, 8, 7, 4, 3, 2, and 1 of Plate IX., marked 44. In *Figs.* 9 and 10, it is observed running in its aqueduct between the vertical canal *p*, and the cochlea C, then between the horizontal canal *c*, and the stapes *w*, around the posterior or central wall of the tympanum, downwards in the bone, to emerge at the foramen stylo-mastoideum, the remainder or continuation of the nerve being described in page 62 of Part II. In the Fallopian aqueduct, the facial nerve is joined by the petrosal twig p of the vidian nerve *v*, as represented in *Figs.* 1 and 2 of Plate IX. This petrosal twig p is also observed in *Figs.* 1 and 2, to give origin to small threads, which supply one of the tympanic muscles, the tensor tympani q. As the facial nerve runs round the posterior wall of the tympanic cavity, it gives origin to a small twig, which is distributed to the tensor tympani muscle,

another to the stapedius muscle, and lastly to the chorda tympani, marked **33**, in *Figs.* 5, 6, 7, and 8 of Plate IX., which emerges at the hollow osseous pyramid p of the tympanum, runs between the long crus 8 of the incus, and the handle 5 of the malleus, across the cavity, and emerges at the fissura Glasseri, and after a short course joins the gustatory branch **32** of the inferior maxillary nerve, as described in page 61 of Part II., and represented in Plate VII. of the same Part. In this course the chorda tympani sends off a twig to the laxator tympani major muscle L, in *Figs.* 1 and 2 of Plate IX. of Part IX.

INDEX

OF

THE LETTERS OF REFERENCE

IN

PART IX.

THE MUSCLES OF THE HEAD AND NECK, TOGETHER WITH THE ORGANS OF SENSE.

PLATE I.

A, Ribs
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C, Insertion of sterno-thyroideus muscle
E, Insertion of sterno-cleido-mastoideus muscle
F, Constrictor pharyngis medius muscle
G, Stylo-hyoideus muscle
I, Œsophagus
K, Trachea
L, Longus colli muscle
R, Rectus anticus major muscle
W, Posterior head of digastric muscle
X, Os hyoides
Y, Constrictor pharyngis inferior muscle

a, Crico-thyroideus muscle
l, Masseter muscle
m, Stylo-glossus muscle
p, Splenius capitis et colli muscle

a, Zygomatic process of temporal bone
c, Capsular ligament of articulation of inferior maxillary bone
d, Angle of inferior maxillary bone

PLATE I. *(Continued.)*

e, Sternum
i, Hyo-glossus muscle
m, Mylo-hyoideus muscle
p, Pharynx
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s, Lateral ligament of inferior maxillary bone
w, Anterior head of digastric muscle

25, Inferior maxillary bone
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PLATE II.

B, Rectus capitis posticus major muscle
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G, Origin of stylo-hyoideus muscle
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L, Longus colli muscle
R, Rectus capitis anticus major muscle
W, Origin of posterior head of digastric muscle
X, Os hyoides
Y, Constrictor pharyngis inferior muscle

b, Mucous coat of pharynx
d, Transverse processes of cervical vertebræ
k, Stylo-pharyngeus muscle
m, Stylo-glossus muscle
n, Internal pterygoid muscle
t, External pterygoid muscle
u, Temporal muscle

a, Zygomatic process of temporal bone
b, Condyle of inferior maxillary bone
d, Angle of inferior maxillary bone
e, Capsular ligament of articulation of inferior maxillary bone
f, Internal pterygoid muscle
h, Interarticular cartilage of inferior maxillary joint
k, Genio-hyo-glossus muscle
l, Genio-hyoideus muscle
q, Styloid process of temporal bone
s, Cornu of thyroid cartilage
y, Constrictor pharyngis superior muscle

25, Inferior maxillary bone

PLATE III. *Fig.* 1.

A, Atlas
B, Tubercle at root of zygomatic process of temporal bone
C, Section of inferior maxillary bone
D, Palato-pharyngeus muscle
E, Rima glottidis
F, Velum palati
G, The tongue
H, Rectus capitis lateralis muscle
K, Trachea
L, Levator palati muscle
N, Cricoid cartilage
Q, Epiglottis
R, Insertion of rectus capitis anticus major muscle
R*, Vertebral artery
S, Thyroid cartilage
T, Posterior aperture of the nares
Y, Constrictor pharyngis inferior muscle

a, Circumflexus palati muscle
b, Mucous coat of pharynx
k, Insertion of stylo-pharyngeus muscle

m, Insertion of stylo-glossus muscle
n, Origin of internal pterygoid muscle
r, Rectus capitis anticus minor muscle
t, External pterygoid muscle

a, Zygomatic process of temporal bone
b, Condyle of inferior maxillary bone
c, Insertion of capsular ligament of inferior maxillary bone
d, Transverse process of atlas
e, Glenoid cavity of temporal bone
f, Uvula
k, Genio-hyo-glossus muscle
l, Unciform process of sphenoid bone
s, Superior cornu of thyroid cartilage
y, Constrictor pharyngis superior muscle

𝔱, Inferior articular process of atlas

𝔩, Transverse ligament of atlas

Fig. 2.

A, Atlas
C, Interarticular cartilage of vertebræ
D, Theca vertebralis
E, Ligamentum commune anticum vertebrarum
R, Vertebral artery

c, Capsules of articular processes of vertebræ
d, Vertebra dentata

a, Body of one of the vertebræ
b, Section of bony ring of vertebra

PLATE III. *Fig.* 2. (*Continued.*)

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d, Transverse process of vertebra
i, Condyle of occipital bone
k, Foramen magnum
m, Anterior margin of foramen magnum
n, Tooth-like process of vertebra dentata
o, Vein joining lateral sinus

1, Transverse ligament of atlas
2, Lateral ligament of atlas
3, Perpendicular ligament
5, Occipital bone

PLATE IV. *Fig.* 1.

A, Tip of the tongue
B, Tubercle at root of zygomatic process of temporal bone
F, Velum palati
I, Œsophagus
K, Trachea
L, Levator palati muscle
N, Cricoid cartilage
Q, Epiglottis
S, Thyroid cartilage
T, Posterior aperture of the nares
V, Hard palate

a, Circumflexus palati muscle
b, Mucous coat of pharynx
s, Inferior cornu of thyroid cartilage

a, Zygomatic process of temporal bone
e, Glenoid cavity of temporal bone
f, Uvula
g, Thyro-arytenoideus muscle
h, Foramen cœcum of tongue
i, Condyle of occipital bone
k, Genio-hyo-glossus muscle
l, Unciform process of sphenoid bone
m, Crico-arytenoideus posticus muscle
n, Arytenoideus obliquus muscle
o, Foramen condyloideum posterius
p, Crico-arytenoideus lateralis muscle
q, Arytæno-epiglottideus muscle
r, Arytenoideus obliquus muscle
s, Superior cornu of thyroid cartilage
t, Arytenoideus transversus muscle
u, Azygos uvulæ muscle
x, Apex of arytenoid cartilage
z, External pterygoid process of sphenoid bone

1, Constrictor isthmi faucium muscle
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PLATE IV. *Fig.* 2.

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S, The thyroid cartilage
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V, Ventricle of glottis

a, Vocal chord
b, Ligamentous band between arytenoid cartilage and epiglottis
c, Arytenoid cartilage
d, Ligament supporting epiglottis
e, Ligamentous band extending between os hyoides and thyroid cartilage
r, Membrane extending between os hyoides and thyroid cartilage
s, Superior cornu of thyroid cartilage
x, Cornu of os hyoides

Fig. 3.

N, The nose

f, Frenum of lower lip

f, Frenum of upper lip

i, Levator labii inferioris muscle
l, Glandular structure of lower lip
s, Depressor labii superioris muscle
u, Labial glands

PLATE V. *Fig.* 1.

A, Antrum maxillare
D, Columna nasi
F, Velum pendulum palati
G, Root of tongue
P, Palatine cell
Q, Epiglottis
T, Posterior aperture of nares
X, Bodies of cervical vertebræ
Y, Section of occipital bone
Z, Aperture to Eustachian tube
b, Mucous membrane of pharynx

b, Crista galli
c, Nasal lamella
*c**, Arytenoid cartilage
*f**, Ethmoidal cells
*g**, Section of cuneiform process of occipital bone
g, Sphenoidal cell

PLATE V. *Fig.* 1. (*Continued.*)

g, Section of cuneiform process of sphenoid bone

1*, Section of frontal bone
2, Posterior arch of fauces
3, Tonsil

Fig. 2.

A, Perpendicular cartilage of nose
B, Lateral cartilage of nose

C, Ligamentous membrane of nose
D, Columna nasi
E, Anterior aperture of nares

Fig. 3.

A, Antrum maxillare
D, Columna nasi
E, Anterior aperture of nares

b, Crista galli
c, Nasal lamella
d, Superior spongy bone
g, Sphenoid cell

1*, Section of frontal bone

2, Probe passed from the nose up to frontal sinus
3, Probe passed from the nose up along the lacrymal duct
4, Probe passed from the nose into sphenoid cell
5, Probe passed from the nose into ethmoid cell

PLATE VI. *Fig.* 1.

D, Columna of the nose
E, Cavity of the nares

b, Crista galli of ethmoid bone
c, Nasal septum
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1*, Section of frontal bone

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3, Probe indicating course of lacrymal duct
4, Probe showing the communication between sphenoidal cells and nares

PLATE VI. *Fig.* 1. (*Continued.*)

5, Probe introduced into ethmoidal cells
6, Probe introduced into antrum maxillare
7, Schneiderian membrane lining cavity of nares
23, Represents the surface where the inferior spongy bone has been detached

Fig. 2.

P, Palatine cell

f, Frontal sinus
*f**, Ethmoidal cells
g, Sphenoidal cell
3, Probe introduced into lacrymal duct
6, Foramen leading to antrum maxillare
23, Indicates the surface where the inferior spongy bone has been detached.

Fig. 3.

A, Antrum maxillare

Fig. 4.

P, Spheno-palatine branch of superior maxillary nerve

p, Palato-maxillary branch of superior maxillary nerve

c, Malar twig of superior maxillary nerve
d, Dental twigs of superior maxillary nerve
f, Uvula
l, Lacrymal twig of ophthalmic branch of fifth pair of nerves
v, Vidian branch of superior maxillary nerve

1, Ophthalmic branch of fifth pair of nerves
1*, Frontal twig of first branch of fifth pair of nerves
2, Infra-orbitary branch of superior maxillary nerve
2*, Superior maxillary branch of fifth pair of nerves
3, Inferior maxillary branch of fifth pair of nerves
5, Trunk of fifth pair of nerves

PLATE VI. *Fig.* 5.

A, Antrum maxillare
P, Spheno-palatine branch of superior maxillary nerve

a, Nervous twig distributed on antrum maxillare

v, Vidian branch of superior maxillary nerve

2, Infra-orbitary branch of superior maxillary nerve
2*, Superior maxillary nerve

PLATE VII. *Fig.* 1.

F, Velum pendulum palati
P, Palatine branch of superior maxillary nerve

V, Hard palate

f, Uvula

Fig. 2.

A, Apex of tongue
D, Dorsum of tongue
K, First ring of trachea
N, Cricoid cartilage
Q, Epiglottis
S, Thyroid cartilage
X, Body of os hyoides

S, Inferior cornu of thyroid cartilage

e, Round-shaped ligament extending between superior cornu of thyroid cartilage and cornu of os hyoides
r, Membranous ligament extending between os hyoides and thyroid cartilage
s, Superior cornu of thyroid cartilage
x, Cornu of os hyoides

Fig. 3.

A, Apex of tongue
D, Mesial line on dorsum of tongue
Q, Epiglottis
S, Side of tongue

h, Foramen cœcum of Morgagni

13, Glosso-pharyngeal nerve

PLATE VII. *Fig.* 4.

A, Apex of tongue
D, Dorsum of tongue

3, Lingual nerve

13, Glosso-pharyngeal nerve
32, Gustatory branch of inferior maxillary nerve

PLATE VIII. *Fig.* 1.

B, Lobulus
C, Concha
D, Anterior auris
H, Helicis major muscle
W, Zygomatic process of temporal bone

c, Antihelix
r, Attollens aurem muscle
s, Parotid gland

a, Helix
c, Crura of antihelix
e, Tragus
g, Temporal artery
h, Helicis minor muscle
i, Fossa innominata
m, Meatus auditorius externus
n, Fossa navicularis
o, Antitragus

Fig. 2.

B, Lobulus
C, Concha
D, Anterior auris
H, Helicis major muscle
T, Tragicus muscle
W, Zygomatic process of temporal bone

c, Antihelix
r, Attollens aurem muscle
s, Parotid gland

a, Antihelix
c, Crura of antihelix
e, Tragus
g, Temporal artery
h, Helicis minor muscle
i, Fossa innominata
m, Meatus auditorius externus
n, Fossa navicularis
o, Antitragus
r, Antitragicus muscle

PLATE VIII. *Fig.* 3.

B, Lobulus
R, Retrahentes auris muscle
a, Helix

Fig. 4.

B, Lobulus
U, Transversus auris muscle
a, Helix
p, Cartilaginous tube of external ear

Fig. 5.

B, Lobulus
C, Concha
W, Zygomatic process of temporal bone

C, Antihelix
Z, Eustachian tube

a, Helix
c, Crura of antihelix
e, Tragus
i, Fossa innominata
m, Meatus auditorius externus
*m**, Mastoid process
n, Fossa navicularis
o, Antitragus
p, Cartilaginous portion of auditory tube
q, Styloid process
r, Membrana tympani

Fig. 6.

A, Fallopian aqueduct
W, Zygomatic process of temporal bone
Z, Osseous portion of Eustachian tube

m*, Mastoid cells
o, Foramen ovale
p, Osseous pyramid of tympanum
r, Foramen rotundum
t, Tympanic cavity
a, Promontory of tympanum
c, Protuberance made by external semicircular canal

1**, Bristle indicating semi-osseous canal of tensor tympani muscle
2, Bristle indicating Fallopian aqueduct, and emergence of chorda tympani nerve

PLATE VIII. *Fig.* 7.

c, Cochlea
M, Inferior recess of meatus auditorius internus, which gives entrance to auditory nerve
v, Vestibule
z, Osseous portion of Eustachian tube

m, Commencement of Fallopian aqueduct
m', Mastoid cells

b, Ridge dividing meatus auditorius internus

c, External or horizontal semicircular canal
o, Oblique or posterior semicircular canal
p, Vertical or superior semicircular canal
p-*o*, Union or tubulus osseus communis

1*, Head of malleus
3, Long slender process of malleus
5, Handle of malleus
6*, Body of incus
7*, Short crus of incus

Fig. 8.

a, Auditory ring of temporal bone
r, Membrana tympani
w, Base of stapes

1*, Head of malleus
3, Long slender process of malleus

5, Handle of malleus
6*, Body of incus
7*, Short crus of incus
8, Long crus of incus
9, Short anterior crus of stapes
10, Long posterior crus of stapes
17, Apex of stapes

Fig. 9.

p, Osseous pyramid of tympanum
r, Foramen rotundum

w, Base of stapes resting on foramen ovale

9, Short anterior crus of stapes
10, Long posterior crus of stapes
17, Apex of stapes

Fig. 10.

c, Cochlea
v, Vestibule

r, Foramen rotundum

c, External or horizontal semicircular canal
o, Oblique or posterior semicircular canal
p, Vertical or superior semicircular canal

PLATE VIII. *Fig.* 11. Malleus.

1*, Head of malleus
2, Cervix of malleus
3, Long slender process of malleus
4, Short process of malleus
5, Handle of malleus

Fig. 12. Malleus.

1*, Head of malleus
2, Cervix of malleus
3, Long slender process of malleus
4, Short process of malleus
5, Handle of malleus

Fig. 13. Incus.

6*, Body of incus
7*, Short crus of incus
8, Long crus of incus

Fig. 14. Incus.

6*, Body of incus
7*, Short crus of incus
8, Long crus of incus

Fig. 15. Stapes.

w, Base of stapes

9, Short anterior crus of stapes
10, Long posterior crus of stapes
17, Apex of stapes
18, Membrane of stapes

Fig. 16.

A, Fallopian aqueduct

o, Foramen ovale
p, Osseous pyramid of tympanum
r, Foramen rotundum

a, Promontory of tympanum
c, Elevation made by external semicircular canal
t, Boundary of tympanum

1**, Semi-osseous canal of tensor tympani muscle
2, Bristle inserted in Fallopian aqueduct
33, Dotted line, indicating course of chorda tympani nerve

PLATE IX. *Fig.* 1.

Z, Cartilaginous portion of Eustachian tube

44, Facial nerve

See Fig. 2.

Fig. 2.

L, Laxator tympani major muscle

P, Petrous portion of temporal bone, covered by dura mater

Z, Osseous portion of Eustachian tube

m*, Mastoid cells

p, Petrosal twig of vidian nerve

q, Tensor tympani muscle

q*, Tendon of tensor tympani muscle

z, Cartilaginous portion of Eustachian tube

m, Meatus auditorius externus

r, Membrana tympani

1*, Head of malleus

1**, Semi-osseous canal of tensor tympani muscle

4, Foramen ovale

44, Facial nerve

Fig. 3.

D, Petrous portion covered with dura mater

I, Twig of vidian nerve assisting to form the great intercostal nerve

p, Petrosal twig of vidian nerve

v, Vidian nerve

g, Cuneiform process of sphenoid bone

1, Nervus vagus

6, Sixth pair of nerves

7, Great intercostal nerve

12, Accessory nerve of Willis

19, Internal carotid artery

44, Facial nerve

See Fig. 4.

Fig. 4.

C, Cochlea

D, Petrous portion covered with dura mater

I, Twig of vidian nerve assisting to form the great intercostal nerve

PLATE IX. *Fig.* 4. (*Continued.*)

l, Laxator tympani minor muscle
m*, Mastoid cells
p, Petrosal twig of vidian nerve
q, Tensor tympani muscle
q*, Tendon of tensor tympani muscle

c, External or horizontal semicircular canal
m, Meatus auditorius externus
p, Superior or vertical semicircular canal
r, Membrana tympani
v, Vidian nerve

𝔭, Cuneiform process of sphenoid bone

1*, Head of malleus
1**, Semi-osseous canal of tensor tympani muscle
3, Long slender process of malleus
6*, Body of incus
7*, Short crus of incus
8, Long crus of incus
44, Facial nerve

Fig. 5.

See Fig. 6.

Fig. 6.

c, Cochlea
D, Petrous portion invested with dura mater

m*, Mastoid cells

c, External or horizontal semicircular canal
m, Meatus auditorius externus
p, Superior or vertical semicircular canal

1*, Head of malleus
3, Long slender process of malleus
5, Handle of malleus
6*, Body of incus
7*, Short crus of incus
8, Long crus of incus
33, Chorda tympani nerve

Fig. 7.

See Fig. 8.

PLATE IX. *Fig.* 8.

C, Cochlea
D, Petrous portion invested with dura mater

p, Osseous pyramid of tympanum
q, Tensor tympani muscle
q*, Tendon of tensor tympani muscle

c, External or horizontal semicircular canal
p, Superior or vertical canal

1*, Head of malleus
3, Long process of malleus
6*, Body of incus
7*, Short crus of incus
8, Long crus of incus
33, Chorda tympani nerve
44, Facial nerve

Fig. 9.

See Fig. 10.

Fig. 10.

C, Cochlea
D, Petrous portion invested with dura mater

m*, Mastoid cells
p, Osseous pyramid of tympanum
r, Foramen rotundum
s, Stapedius muscle

c, External or horizontal semicircular canal

l, Lamina spiralis
p, Superior or vertical semicircular canal
w, Base of stapes resting on fenestra ovalis
*w**, Vestibular scala of cochlea

9, Anterior crus of stapes
10, Posterior crus of stapes
17, Apex of stapes
19, Internal carotid artery
44, Facial nerve

Fig. 11.

C, Base of cochlea
C*, Septum scalarum

a, Cupola
g, Hamulus

h, Canalis scalarum communis
i, Infundibulum
l, Lamina spiralis
m, Modiolus

PLATE IX. *Fig.* 12.

A, Aqueduct of Fallopius
C, Cochlea
V, Vestibule

r, Foramen rotundum

c, External or horizontal semicircular canal

l, Lamina spiralis
p, Vertical or superior semicircular canal
p-o, Tubulus osseus communis
*w**, Aperture leading from the vestibule to the cochlea

Fig. 13.

A, Aqueduct of Fallopius
C, Cochlea
V, Vestibule

r, Foramen rotundum

c, External or horizontal semicircular canal

l, Lamina spiralis
o, Oblique or posterior semicircular canal
p, Vertical or superior semicircular canal
p-o, Tubulus osseus communis
*w**, Aperture leading from the vestibule to the cochlea

Fig. 14.

K, External aperture of aqueduct of vestibule
M, Point of entrance for auditory nerve

m, Commencement of Fallopian aqueduct in meatus auditorius internus

b, Ridge dividing meatus auditorius internus
k, External aperture of aqueduct of cochlea

Fig. 15.

C, Cochlea
M, Meatus auditorius internus
V, Vestibule

q, Tensor tympani muscle

c, External or horizontal semicircular canal

PLATE IX. *Fig.* 15. (*Continued.*)

o, Oblique or posterior semicircular canal
p, Vertical or superior semicircular canal

1*, Head of malleus
6*, Body of incus
7*, Short crus of incus

Fig. 16.

A, Pinna
C, Concha
L, Laxator tympani major muscle
T, Fissure between helix and tragus
W, Fissure between helix and antitragus
X, Fissure at base of tragus

c, Antihelix

a, Helix
c, Crura of antihelix
d, Process of helix
e, Tragus
i, Fossa innominata
n, Fossa navicularis
o, Antitragus
r, Membrana tympani

Fig. 17.

C, Cochlea
G, Pyramid of vestibule.
H, Cavitas hemispherica
V, Vestibule

c, External or horizontal semicircular canal

f, Aqueduct of vestibule
p, Vertical or superior semicircular canal
p-o, Tubulus osseus communis
s, Cavitas sulciformis
t, Aqueduct of cochlea

PLATE X. *Fig.* 1.

C, Caruncula lacrymalis
P, Plica semilunaris
S, Supercilium
T, Superior tarsus

t, Inferior tarsus

p, Punctum lacrymale

PLATE X. *Fig.* 2.

B, Nasal process of superior maxillary bone
G, Cavity of lacrymal sac
L, Levator palpebræ superioris muscle
O, Tendon of superior oblique muscle

W, Orbicularis palpebrarum muscle

b, Internal angular process of frontal bone
c, Cartilaginous pulley of superior oblique muscle
i, Inferior oblique muscle
l, Lacrymal sac
o, Membranous sheath of superior oblique muscle
p, Punctum lacrymale
q, Lacrymal gland
s, Corrugator supercilii muscle
t, Ligament of the tarsi

1, Bristle inserted in inferior canaliculus lacrymalis
2, Bristle inserted in superior canaliculus lacrymalis
13, Os nasi

Fig. 3.

D, Dura mater
G, Ganglion of Glasserus
L, Levator palpebræ superioris muscle
O, Superior oblique muscle
T, Superior tarsus

f, Frontal twig of ophthalmic branch of the fifth pair of nerves

a, Cribriform lamella of ethmoid bone
b, Crista galli
f, Frontal sinus
g, Sphenoid cell
l, Lacrymal twig of ophthalmic branch of the fifth pair of nerves
n, Nasal twig of ophthalmic branch of the fifth pair of nerves
p, Twig of frontal nerve, which supplies cartilaginous pulley of superior oblique muscle and lacrymal muscle
q, Lacrymal gland

*, Bristle inserted into canal of communication between frontal sinus and the nose

1, First or ophthalmic branch of the fifth pair of nerves
2, Optic nerve
2*, Second or superior maxillary branch of the fifth pair of nerves
3*, Third or inferior maxillary branch of the fifth pair of nerves
3, One of the third pair of nerves, or motor oculi
4, One of the fourth pair of nerves, or pathetic nerve
5, One of the fifth pair of nerves, or trigeminal nerve
6, One of the sixth pair, of nerves, or abducens nerve
19, Internal carotid artery

PLATE X. *Fig.* 4.

A, Attollens vel levator oculi muscle
D, Dura mater
L, Levator palpebræ superioris muscle
O, Superior oblique muscle
T, Superior tarsus

a, Adductor oculi muscle
f, Frontal twig of ophthalmic branch of the fifth pair of nerves
g, Lenticular ganglion

a, Abductor oculi muscle
b, Crista galli
c, Cartilaginous pulley of superior oblique muscle
l, Lacrymal twig of ophthalmic branch of the fifth pair of nerves
n, Nasal twig of ophthalmic branch of the fifth pair of nerves
q, Lacrymal gland

1, First or ophthalmic branch of the fifth pair of nerves
2, One of the second pair, or optic nerves
2*, Second or superior maxillary branch of the fifth pair of nerves
3, One of the third pair of nerves, or motor oculi
3*, Third or inferior maxillary branch of the fifth pair of nerves
5, One of the fifth or trigeminal nerves
6, One of the sixth, or abducentes nerves
19, Internal carotid artery
20, Twig of the third pair of nerves distributed on levator palpebræ muscle

PHYSIOLOGICAL

AND

PATHOLOGICAL OBSERVATIONS.

THE pabulum of life, taken up by the absorbents, is conducted by the thoracic duct to the venous system, which it joins at the angle formed by the internal jugular and the subclavian veins of the left side. This subclavian vein, having the nutritious lymph blended with the blood returned from the left side of the head and the upper extremity, soon unites with the subclavian vein of the right side, returning the blood of the arm and head of the same side, and forms the vena cava descendens, which is immediately joined by the vena azygos. The vena cava descendens, by its undulatory motion, propels the blood onwards to the right or pulmonic auricle,* where meeting with that returned by the vena cava ascendens, which is the trunk of the venous system of the lower extremities and the abdomen, and that returned by the coronary vein of the heart, the fleshy parietes of this auricle are distended, stimulated to action, and contracting, propel the blood

* Syn. Right sinus venosus.

through the tricuspid valve into the right or pulmonic ventricle; the blood being prevented flowing downwards into the inferior vena cava by the valve of Eustachius, and the accumulation of blood advancing to pursue the same course; and from flowing upwards by the current of blood, and the vis a tergo. When the right ventricle is distended, its fleshy parietes are excited, which contracting propel the blood out of the cavity, at the mouth of the pulmonary artery; the blood being prevented regurgitating into the right auricle by the tricuspid valve stretching across the aperture, from the blood stimulating its columnæ carneæ to contraction: and in order that the ventricle may be thoroughly distended, the semilunar valves at the mouth of the pulmonary artery offer, in the commencement of the distension of the cavity, a resistance to the blood, in consequence of their being filled with this fluid when the pulmonary artery contracted to propel the blood which immediately preceded. Part of the tricuspid valve also assists in forming this obstacle to the flow of blood at the pulmonary artery, by its partly overlapping the opening into the artery. The blood then enters the pulmonary artery, which being stimulated, contracts, and propels the fluid through its branches in the lungs, where giving off carbonaceous matter, and assuming a vermilion hue, it returns by the four pulmonary veins into the left or systemic auricle* of the heart; which being similarly excited, contracts, and propels the blood through the mitral valve into the left or systemic ventricle; which also similarly contracting, propels the blood into the aorta, the branches of which maintaining the like contractile motion, propel the blood over all the system, its gelatinous and fibrous part being retained

* Syn. Left sinus venosus.

in the cells of that vascular parenchyma, that forms the basis of the whole fabric. While one portion flows to the brain to stimulate the source of the nervous system, other portions are entangled in the peculiarly-formed labyrinths of the glands, in the excretory ducts, and the exhaling vessels, forming the various secretions and excretions. The remainder of the blood, impregnated with carbon, and of a dark red colour verging to purple, returns by the veins to undergo the same course. The blood in the pulmonary artery is prevented returning into the right ventricle by the distention of the three semilunar valves at its mouth, and from the aorta into the left ventricle by the same wise arrangement. The mitral valve opposes a similar barrier to the blood regurgitating into the left auricle, that the tricuspid valve does between the right ventricle and its corresponding auricle. The mitral, like the tricuspid valve, also assists in preventing the blood, on its entrance into the ventricle, flowing out at the aorta. The mechanism of the tricuspid and mitral valves is such, that when the blood presses on them from behind, they all meet in the centre of the aperture, so as to effectually shut up the passage; and the flaps of the mitral valve even overlap each other. When the auricles act, the columnæ carneæ, and chordæ tendineæ, prevent the membranous valves falling into the auricles; and when the ventricles act, those fleshy columns contract and moderate the distance which the flaps might otherwise have, and prevent them also falling into the auricles.

On opening the thorax of a living animal, the blood is observed to flow from the veins into both the auricles at the same moment of time, so as to distend them; and they are no sooner filled than they contract, and propel the blood into the ventricles, which being also distended, contract by the apex approximating the centre of the

cavity, and inject the blood into the arteries. Thus both the auricles and ventricles are filled and emptied, the auricles distending while the ventricles are contracting, and vice versâ; and the auricles being no sooner emptied, than they are filled again from the veins. When the venæ cavæ and pulmonary veins are emptying themselves, the ventricles are also contracting; and while the auricles are propelling their blood into the ventricles, the pulmonary artery and aorta are at the same time contracting. The cavity which first ceases to contract at death is the left ventricle; secondly, the left auricle; thirdly, the right ventricle; and lastly, the right auricle, which last continues longest to vibrate: hence, when the heart is laid open, very little blood is found in the left side, while it is accumulated on the right side.* When the auricles contract, the veins become swollen, which appearance extends even to their ramifications, from the regurgitation or impediment to the flow of the blood which has been thus accumulating in its course onwards to enter the auricles. Thus we observe there are no effective valves at the entrance of the venæ cavæ, in order to allow the blood to regurgitate out of the heart when any impediment occurs. The auricles, from their structure, seem capable of expelling all their contents.

When the cavities of the heart are opened in a living animal, the septum ventriculorum and columnæ carneæ are observed shortening themselves, so as to propel their contents into the arteries; and during relaxation of the different cavities, the sides are in contact, or collapsed, and the heart expands or passes into the diastole, and remains in that state till the blood stimulates it to contract; and after death, the muscular parietes and columns

* This order should be considered in medical jurisprudence.

possess little or no elasticity, so that the heart appears to have no power of distending itself; but the auricles become swollen by the blood poured into them by the veins, and the ventricles are distended by the blood propelled into them by the auricles, one and all of them contracting by the blood stimulating their muscular parietes through the medium of the nerves, the same as takes place in the alimentary canal from the stimulus of the food, or, as is evidenced in the lacteal vessels, from the stimulus of the lymph. The naturally collapsed state of the cavities, and their distension solely by the blood, will cause them to contract with more energy, and enable them to expel more completely all the blood; and hence the greater the quantity of the blood circulating in the viscus in a given time, the more forcible are its contractions, as is exemplified in running, or any other active exercise.*

At birth, the heart contracts from 130 to 140 in the minute; at one year old, 120; at two years old, 110; at three years, 90; at seven years, 85; at fifteen years, or puberty, 80; at mature age, from 65 to 75; and in old age, between 60 and 70;—all, however, varying considerably in different individuals.† The cause of a single sensation of a palpitation of the heart, is the contraction of the ventricles, arising from a change of the situation of the apex of the heart striking against the cartilages of the ribs; and at the same moment that the ventricles are contracting, the left auricle is filling, which cavity being

* These different motions of the heart have been witnessed in cold and warm-blooded animals by a number of experimenters, by Steno, Bartholinus, Peyer, Lewenhoeck, Willis, Caldesi, Harvey, Pecquet, Lancisius, Muraltus, Maitre Jean, Senac, Haller, and Spallanzani.

† These differences of the pulse should be carefully considered by the practitioner, that he may be able to calculate the aberration in disease.

placed posteriorly, or dorsad, will strike the vertebræ, so as to assist in producing this sensation. The exterior fibres are seen to curl themselves, the apex is attracted to the base, the heart becomes shorter and blunter, and is bent forwards and to the right, or sternad and dextrad. The curve in the apex of the heart is ascribed to the straightening of the aorta while it is filling. As each ventricle can hold between two and three ounces of blood after death, it is consistently supposed, that this quantity is ejected into the arteries at each time in life; and according to the most unexceptionable calculations, the quantity of blood in the body is estimated at thirty pounds, each pound being twelve ounces. About two ounces of blood, therefore, leave the heart at each contraction; and as there are seventy contractions occurring in the minute, the whole mass of blood circulates about twenty-three times in an hour, or once in two minutes and a half.*

The powers of the muscular structure of the heart have been estimated by Borelli, Hales, and Haller, but seemingly in a very defective manner. From the circumstances required to be taken into calculation, it appears to be extremely difficult; these are the area of the heart, the area of the aorta, the quantity of blood propelled, the velocity of the blood, the resistance, &c. all of which can scarcely be ascertained, and even if ascertained in one, there is so much variety in different individuals, that it is probable it would be of little advantage.

To direct the heart in its motions, to afford it liberty, and to prevent friction, the heart is provided with a capsule, named pericardium, the dimensions of which are a little larger than its greatest expansions, and from the sur-

* This rapidity of the circulation enables us to explain the quick discharge of fluids by the urine, when diuretics are given.

face of both of which a serous fluid is poured out. That the pericardium directs or limits the motions of the heart we are entitled to conclude, from its being found stronger in those animals that have no diaphragm, and also from its adhesion to the diaphragm being only found in man, and some of the simiæ who walk erect. The pericardium is firmly fixed to the diaphragm, which in expiration brings the upper part of it to the level of the fourth rib. The serous fluid, besides the uses already ascribed to it, also prevents adhesion of the heart to the pericardium: this fluid was observed by Spallanzani in living salamanders, so that it does not appear to be the condensation of a halitus after death. When coloured water is injected into the coronary arteries, it transudes by a multiplicity of pores from the surface of the heart, the large blood-vessels, and the pericardium. This fluid of the pericardium is generally about a drachm or tea-spoonful in quantity, and is often of a yellowish colour, from bile. The analysis is, water 92, albumen 5, mucus 2, muriate of soda $\frac{5}{10}$.*

The heart is present in all animals, with the exception of insects and zoophytes. It varies a little in its shape in quadrupeds, birds, and several fishes; in some of the latter it is short and thick, in other fishes it is cylindrical, in others semicircular, while in others again it is long and slender, and in others quadrilateral. In the mollusca, it is sometimes lobed, and sometimes semicircular. In man, we find it conical, and fixed by its large vessels at the right side and base, while its middle, left side, and apex are left free, the latter having an oblique direction to the left side, its flat surface resting on the

* Littre details the case of a woman who lived to 54 years of age without the pericardium. The heart was dry, rugged, and hard, and had little adipose substance. She is stated never to have enjoyed good health.

diaphragm, with the intimate connection of the pericardium to the latter. No animal which has veins is found destitute of auricles or sinus venosi, but they are absent in those animals whose hearts are long, and which viscus also constitutes the principal artery, and in whom the veins cannot be distinguished from the arteries.

Amphibious animals have the largest auricles, which may assist them in remaining long under water. There are two auricles in those warm-blooded animals that have two ventricles and four great vessels, and that propel the whole blood of the right ventricle through the lungs before it arrives at the left ventricle, as in mammalia and birds. One auricle is found where there is one ventricle, and where only a small portion of the blood runs through the lungs, as in cold-blooded animals, or in those whose blood is a trifle warmer than the circumambient water. One auricle is also only found in oviparous quadrupeds.

The mollusca differ materially in the parts of the heart; all of them have a left or systemic ventricle; many have a dilatation of the venæ cavæ compared to an auricle, and two lateral hearts or ventricles: the heart is sometimes lobed, and sometimes semicircular. The seiches have two hearts separated, and the pulmonary is divided into two. The lingules have the systemic heart divided into two. The pectinibranches have two auricles. The acephalous mollusca have either two lateral hearts or ventricles, or one ventricle with one or two auricles; or only a simple systemic ventricle, as the acephalous tuncata. The larger crustacea have two ventricles. Fishes have only one auricle, and one ventricle, the latter of which is placed at the commencement of the pulmonary artery. Reptiles have either two auricles and one ventricle, or one auricle and one ventricle.

In the fetus, the heart is larger in proportion than in

the adult. It is larger in quadrupeds and birds of a small, than in those of large size. In birds, the heart is found larger than in quadrupeds; and the same relative proportion is stated by Haller to be found in ferocious animals, compared with tame animals; but Hales contradicts this, for he found timorous animals, as deer, asses, and hares, to have larger hearts than courageous ones. Male animals are stated to have larger hearts than females. The heart is smallest in fishes, and smaller in cold-blooded than in warm-blooded fishes. Valisnerus observes, that the columnæ carneæ are most numerous in swift running animals, as the stag or hare.

The heart being supplied with nerves, and being a muscular viscus, possesses the powers of contractility, or those of sensibility and motion, in a marked degree. The heart is sensible to numerous stimuli after death, and the more so the earlier it is experimented on; a drop of saliva, or any acid, or a particle of common salt, excites its contractions; so also does the stroke of a probe, the prick of a needle, the separation of the sides of the thorax, or the blowing of air into the large veins contiguous to the heart. Electricity and galvanism are powerful agents in restoring the motions of the heart after death; as also the inflation of the lungs, and stimuli to the brain.* Experiments on the heart are best elucidated on those animals which have the nervous system much diffused, as in the cold-blooded.

When air, water, or vinegar is injected into the veins leading to the heart, its action is increased, and the more so according to the stimulus; from which we can account

* In asphyxia these agents, as electricity, galvanism, the resuscitating bellows, stimuli to the head, as hot sinapisms, or pungent salts to the nostrils, should be employed. Stimuli into the stomach also excite the heart's motions.

for salt or pungent provisions, or stimulating liquors, exciting an undue action in the heart, independent of their first operation on the nerves of the alimentary canal. Hales observes, that the force of the blood is very different, not only in animals of different species, but also in animals of the same kind, and even in the same animal, where it is continually varying according to the different kinds and quantities of food, the various distances of time after taking food, the more or less plethoric state of the system; also from exercise, rest, different states of vigour or vivacity of mind in the animal, likewise from climate, heat, cold, and evacuations, so as probably never to be exactly the same any two minutes during the whole life of the animal. Dr. Bostock analysed the serum of the blood of a young lady, who had been taking for some time the subcarbonate of soda, to the extent of three ounces daily, and found it much more strongly alkaline than ordinarily.

The exposure of the heart to a moderate degree of cold, or to caloric, increases the number of its contractions; while an intense degree of cold suppresses them by impeding its motions, and a great degree of caloric arrests them by exhausting its motions. Alcohol and opium seem to have a similar mode of operation to caloric; they at first increase, but soon diminish the heart's motions by exhaustion. Opium has a more transient stimulation than alcohol.

Irritation, injury, or even destruction of various parts of the nervous system, generally increase the contractions of the heart for a time, which, however, are frequently very feeble; but compression of the nervous system impedes or suppresses these actions. These are exemplified in phrenitis caused by irritation of blood, and in compression of the brain from matter, water, blood, or depressed

bone.* Almost every emotion of the mind influences the actions of the heart; thus this viscus acts more frequently in joy, more quickly and strongly in anger, more slowly and languidly in grief. The happy influence of joy, or mental exhilaration on the heart and general system, is admirably illustrated in the history of the siege of Breda, and in Colonel Stewart's interesting Sketches of the Highland Regiments in the West Indies. These, and other similar facts, prove that the heart is indirectly voluntary. Hales, by his experiments, proves that sighing increases the actions of the heart and arteries, consequently study or anxiety is injurious in pectoral complaints.

The external objects of nature operating on the organs of sense, influence the actions of the heart; thus different scenes in nature produce different effects, placid scenery tranquillizes them, wild picturesque scenery quickens them, and a parterre of roses accelerates them.

Certain sensations are also found to affect the actions of the heart, as various smells. The smell of the white lily has been known to produce immediate fainting, so also that of boiled beans, or that from the snuff of a candle. Pain likewise operates in a similar manner, as a blow on the knee or testis, or a surgical operation. The application of tobacco leaves over the region of the stomach diminishes the actions of the heart, so also does this narcotic when administered per rectum. Any substance disturbing the functions of the alimentary canal influences the actions of the heart; thus the gas evolved in the stomach in dyspepsia, by exciting the expanse of the par vagum, instantaneously produces palpitation and

* The experiments of Dr. Wilson Philip, and M. Le Gallois, throw much light on the effects of causes operating on the brain and spinal marrow, and ultimately on the heart; they, in my opinion, satisfactorily establish the most direct chain of connexion between these organs.

irregular action of the heart. Narcotics passing along the pharynx and œsophagus into the stomach, operate on the nervous expanse of these organs, and thus influence both directly and indirectly the motions of the heart; directly, through the medium of the par vagum to the heart, and indirectly, through the medium of the brain. The swallowing of ether and laudanum in combinationis an excellent illustration. An infusion of tobacco, or the Prussic acid, when swallowed, instantaneously overpowers the nervous system, and then the actions of the heart. The metallic poisons irritate, and then destroy, the nerves of the stomach, and hence influence the actions of the heart. Diseases of the bowels produce, through the medium of the nerves, a quickened action of the heart.

Substances, through the medium of the lungs, affect the motions of the heart; thus, the breathing of the fumes of alcohol, or nitrous oxide, increases them, while those of hydro-carbon, or pure carbonic acid gas, diminish them.* The actions of the heart can also be influenced through the medium of the skin; thus cold or heat applied to the surface, either accelerates or lessens them, according to the time of duration.† All these effects are produced by these various agents operating through the medium of the nerves.

Besides the quality of the blood stimulating the heart, the quantity circulating in the viscus increases its contractions, and the greater the quantity of blood entering the heart in a given time, the more is the action increased, in consequence of the parietes having a natural tendency to collapse. This is satisfactorily proved in running, or

* The breathing of hydro-carbon is an excellent remedy in mania, to suspend the diseased intellectual functions for a time.

† It is from these effects that cold, warm, and vapour baths prove so valuable remedies in disease; the vapour in cutaneous diseases, the warm in fevers, and the cold for convalescents.

any other active exercise. Such violent voluntary muscular actions at first increase the number and strength of the contractions of the heart, but when long continued, the number increases, although not the strength, the functions of the heart becoming exhausted, in consequence of the structure being unable to keep up for any length of time this forced action.

The muscular fibres of the heart themselves are sometimes acted on by the venous blood getting access to the coronary arteries, as in asphyxia, which diminishes the sensibility of the heart.

Blood-letting always diminishes the sensibility of the heart, by first removing a portion of the stimulus to the brain; and, secondly, by lessening the quantity of the stimulus to the heart itself. But this does not always occur in proportion to the quantity abstracted, for some faint from the abstraction of a very small quantity, while others are able to bear a large quantity removed; which effect seems to depend on the firmness of the fabric of the individual. Hence fat flabby people faint sooner than lean firm individuals. In the lean constitution, pressure seems to be kept up between the different structures of the system; while in the loose flabby frame, pressure or support is deficient, and thus it resembles the dropsical habit. Bleeding an individual, while in the erect posture, produces fainting sooner than when in the horizontal, and apparently on the same principles. When erect, the blood cannot be propelled so easily or so quickly to the brain; this organ, therefore, deprived of its wonted pressure or support, and also of its stimulus, is unable to perform its functions, and fainting, consequently, is the result. But the stimulus of the blood to the brain does not account for this effect so well as pressure or support. The depriving of the organ, therefore, of its support,

must be the first effect, which is corroborated by what occurs in paracentesis abdominis for dropsy of that cavity, by what takes place in leaping suddenly out of bed in the morning, or in raising a patient too quickly after fever, or any disease which has confined him long in the horizontal posture. The heart contracts or palpitates more quickly by twelve beats, in the erect than in the horizontal posture; but this varies in different constitutions, particularly in the native of a cold climate, who has resided long in a tropical one. In feeble people it is greater, and in all habits it is greater after eating or drinking, or exercise.

The inflammatory action greatly influences the motions of the heart; hence in inflammation of any degree, the heart always accompanies and constitutes part of the inflammatory fever. Sometimes the quickened action of the heart precedes the appearance of the inflammation, while at other times it follows: in the former, the increased circulation, from whatever cause, so excites the nerves and arteries, that they are unable to return to their wonted quiescence; in the latter, or when the quickened action of the heart follows the inflammation, the heart is excited by the diseased action of the nerves of the part being transmitted along the nerves to the heart.

The quantity of blood circulated by the heart may be increased, or diminished, or be the same as in health, while the motions of this viscus are disturbed. When the quantity is the same as in health, the pulse if more frequent will be feebler, and if slower, will be stronger; in the former, the heart will either never be filled, probably in consequence of increased sensibility, or never be emptied, in consequence of the debility of its muscular powers. The effect of this indicates a derangement in the nervous and muscular systems. If the quantity of blood circulated

by the heart be diminished, the arteries will be contracted, until they become only capable of propelling the blood through the capillary vessels, with a proportionally smaller velocity. The veins will become distended, unless the muscular coat of the arteries can be sufficiently relaxed to afford a diminished tension, which is probably the case. In this state, the pulse is small and weak, and the arteries being partly exhausted, there will be a paleness and chilliness of the extremities, which is also partly produced by a derangement of the nervous system; until the blood that is accumulated in the veins has sufficient power to urge the heart to a greater action. A contrary state now arises, the quantity of blood circulated by the heart is increased, and the pulse is full and strong, the arteries continue to propel the blood easily into the veins, until a relaxation of their capillaries takes place, probably to such an extent, that another general derangement of the circulation is produced. The motion of the blood being accelerated, and the arteries emptied, so that the pulse may be small and weak, while the veins are overcharged, and the heart exhausted by violent and fruitless efforts to restore the equilibrium. When, on the contrary, the capillary vessels are contracted, the arteries are again distended.

From what has been stated in the preceding observations, it will be at once understood, how easily and readily the functions of the heart are deranged, that no disturbance of either the respiratory, the circulating, the alimentary, or the mental functions, or injury to any other function or organ, can take place, without influencing or involving more or less the actions of this important organ. The envelope of the heart is subject to inflammation, and some of its terminations, as adhesion and dropsy, also to a peculiar hardened state, and to ossification.

The heart itself is subject to the following diseases:—to inflammation, and some of its terminations, as suppuration, ulceration, and gangrene; to a peculiar softened state, to hypertrophia, to atrophia, to aneurism, to rupture of its parietes, to the foramen ovale remaining open, to an aperture in the septum ventriculorum forming a communication between the ventricles, to a conversion into cartilage, and to ossification.

Pericarditis and carditis are the terms given to inflammation of the pericardium and the heart, the former being a much more prevalent disease than the latter, and generally occurring in the rheumatic constitution, being frequently combined with pleuritis or pneumonia, and being with difficulty distinguished from the latter. The morbid appearances seen in pericarditis, are, a layer of coagulable lymph on the interior surface of the pericardium, and also on the surface of the heart, occasionally so abundant, as to fill up the space between them, forming a delicate bond of adhesion. The exterior or pleuritic surface also sometimes displays marks of inflammation, in which case the affection is complicated with disease of the pleura. Instead of so great a quantity of lymph being deposited, there is at other times a more or less quantity of serum effused, which is occasionally tinged with blood. The symptoms of this disease are, acute pain in the region of the heart, aggravated on motion or on inspiration; violent palpitation of the heart, but small regular pulse, rendered irregular on motion; irregular, anxious respiration, slight cough, and a tendency to syncope on moving. There is also an anxious expression of countenance. The treatment consists in large and repeated bleedings, the application of blisters in the cardiac region, large doses of Hyosciamus and digitalis, brisk cathartics, enemata, rest, and low diet. There are two

varieties of this as of most other important diseases, namely, the acute, and the chronic, the latter of which is very ill defined in its symptoms.

When pericarditis does not prove fatal, it ends either in an abatement or resolution of the disease, in adhesion of the pericardium to the heart, or in effusion of serum constituting dropsy: when adhesion is the result, the morbid appearance is a greater or less extent of union, through the medium of coagulable lymph, between the pericardium and the heart, which is sometimes so extensive and connected, as to cause many believe that no pericardium existed, this membrane requiring to be patiently dissected off from the heart. The symptoms characteristic of this disease in life, are, a painful sensation of pulling or tugging in the region of the heart, respiration rendered laborious and frequent on the slightest motion, sudden flushings of the countenance, irregular pulse, particularly on moving, and syncope often occurring. There is no palpitation of the heart.

In dropsy of the pericardium or hydro-pericardium, the serous effusion varies from seven ounces to eight pounds, and when it accumulates to this quantity, such pressure is made on the heart, large blood-vessels, and lungs, as to prove fatal. The colour of the fluid is more or less green, and quite transparent. The pericardium is always thickened, and has been found hardened like a dried bladder. The symptoms of this affection are, an oppressive weight in the region of the heart, occasionally attended with palpitations; difficulty of breathing threatening suffocation in the horizontal posture, a painful anxiety, and frequent syncope; obscure and tumultuous pulsations felt over the region of the heart, and in different parts of the thorax, according to the quantity effused; when the patient

stoops forward and inclines rather to the left side, an obscure pulsation felt low down or sacrad in the thoracic çavity, and a more forcible beat in the region of the heart; the pulse small, feeble, frequent, and sometimes irregular; and the face of a bloated violet colour, with blackish livid lips. The treatment consists in giving diuretics and cathartics, as in other dropsical affections, and if the constitution is capable of bearing it, the catharsis ought to be carried as far as possible, as the cure of dropsy is to be accomplished more by this excitement, which rouses the absorbents to greater action, than by diuresis. Riolanus recommends puncturing the pericardium in this dropsical affection, in which he is supported by Senac, and by Desault, who performed what he conceived to be this operation; but after death, the effusion was found collected in a sac formed by the left lungs and the pericardium. If cautiously undertaken, I see no danger to be apprehended from the operation, and shall certainly perform it the first opportunity. An incision should be made between the fifth and sixth ribs through the integuments, but in such a way that the skin may afterwards act as a valve; it should therefore be pulled upwards or atlantad. The greater pectoral and intercostal muscles should then be cautiously divided, the operator keeping sufficiently distant from or lateral to the sternum, so as that he may avoid the internal mammary artery, (*see Plate* 3, *in Part* 2, *Fig*. 3, *digit* 14.) The pleura costalis will most probably be divided along with these muscles, as the pericardium will generally be found adhering to it; the latter seen distended and agitated with the fluid, should now be carefully opened, making a small aperture, with the scalpel, bistoury, or lancet, when the fluid will exude. If the pericardium does not adhere to the pleura costalis,

the incision in the pleura must be enlarged so as to admit the finger, which, when introduced, will feel the distended pericardium, that can then be punctured with a sharp pointed bistoury guided along the finger.

After the operation, it will be requisite to continue the diuretics, and it may also be necessary to repeat the paracentesis as in ascites.

The pericardium has been found distended and hardened like a dried bullock's bladder, and also ossified in one part to a considerable extent.

Carditis, we have already observed, is with difficulty distinguished from pericarditis in the living, but with ease in the dead state: in the latter, the appearances are, an inflamed state of the pericardium, with more or less of a yellowish purulent matter; a deposition of lymph on the surface of the heart, the muscular structure of which is pale, flabby, and soft, being easily torn and separated into layers, in consequence of depositions of purulent matter in the cellular tissue; the blood-vessels enlarged, increased in their branches, and covered with pus; and the cavities filled with coagulable lymph, which extends even into the great vessels. The symptoms of this disease are merely an aggravation of those of pericarditis; and the treatment must consequently be the same, with a similar modification to answer the greater evil. The best marked cases of carditis which I have witnessed, have followed inflammation of a vein from blood-letting, and the throwing a ligature round a wounded vein, as, for instance, the axillary.

Carditis generally terminates in suppuration, the morbid appearances of which have been described. There are also instances where the pus has been confined to an abscess in the fleshy parietes of one of the cavities, and also in the cavities themselves. This state, we may pre-

sume to say, must always prove immediately fatal, so that if the treatment of the inflammatory stage prove ineffectual, there will be no symptoms of the suppurative stage except rigors, and no treatment required. Chronic inflammation of the heart sometimes ends in ulceration, which has been known to go on until the parietes have been eaten through, and then proves fatal by effusion of the blood.* If inflammation of the heart, before it ends in suppuration, proves fatal, this eventful result must occur before gangrene can take place. Storck, however, and Leroux, in Corvisart, detail cases of this termination having been visible, while Corvisart seems to doubt it.

In acute fever the heart is more or less affected, sometimes to the extent of being rendered softer and of a deep red colour, the latter, however, occasionally approaching to brown, and the muscular structure breaking down under the fingers. In patients who have fallen victims to typhus or hectic fever, the heart has been found equally soft and of a white or jaundiced yellow colour. Those who recover from such diseases are naturally very liable to be affected with aneurism of the heart, and hence the great care requisite to be bestowed in recruiting the strength of patients after fever. These softened states of the heart are occasionally the result of idiopathic affections, in which case the one resembles in its symptoms pericarditis or carditis, and the other chronic inflammation.

Chronic inflammation of the heart is extremely difficult of being ascertained before death, in consequence of the symptoms being generally referred to a distant part. Dropsy is a common concomitant, so also is cough, and more or less uneasiness or wandering pains in the thoracic

* See Morgagni and Marchettis.

cavity, accompanied with difficult and laborious breathing; but in some cases, the head is the chief part complained of, in others, the urinary bladder, in others again, dropsy of the abdomen, while in some others the uterine organs are affected. The pulse is generally small, weak, irregular, and sometimes intermitting. On applying the hand over the region of the heart, this viscus will be found to be acting irregularly. The morbid appearances are, fewer or more adhesions between the pericardium and the heart, with occasionally coagulable lymph, and even pus, and more or less softness and paleness of the heart. The treatment consists in early small bleedings, in the repeated application of blisters or issues to the sternum, and in cathartics.

Chronic inflammation is frequently accompanied with dilatation of the heart, rendering the disease very complicated. The dilatation appears to go on with rapidity, is accompanied with fever, and an acute pain is felt sometimes in the epigastric, at others in the hypogastric region. The pulse is frequent, irregular, and jarring.

White spots are frequently found on the surface of the heart, similar to those on the surface of the liver, which appear to consist of depositions of coagulable lymph, but cannot be traced to any local inflammation, however trifling.

Hypertrophia* is a thickening of the parietes of the heart without dilatation,† the left venticle being the cavity generally affected, and is characterized by the following symptoms: a confusion and struggling in the thoracic cavity, the palpitation being communicated to the region of the left clavicle, and when the hand is applied over the heart, it feels as it were repulsed by its pulsations. When

* Syn. L'irritation nutritive du cœur.

† Syn. L'hypertrophie simple.

the region of the heart is percussed with the fingers, there is a dull obscure sound. To those who can use the stethescope dexterously, the pulsations appear very loud and strong, and can in some instances be heard at the back of the patient. There is an inexpressible anxiety and inquietude about the heart, together with a weak, irregular, fluttering, or vibrating pulse. The patient constantly apprehends instantaneous dissolution. Persons labouring under hypertrophia are often very fat. The treatment of this malady consists in small bleedings, issues to the sternum, active purges, low diet, reduction particularly of fluids, and quietness.

Hypertrophia is sometimes accompanied with dilatation or aneurism,* in which case the pulse is strong, full, and vibrating; at other times with contraction of the cavity,† in which case the pulse is generally regular, full, and strong, but occasionally feeble. Hypertrophia of the right ventricle is distinguished by the pulsations of the heart being felt at the inferior or sacral aspect of the sternum, and towards the right side, by bloody expectoration. That of the left ventricle, by the pulsations being felt between the fifth and sixth ribs of the left side, by the countenance being flushed of a vermilion tinge, by bleedings of the nose, by deafness and headach.

The heart is also subject to atrophy, or wasting of its muscular substance, which is frequently accompanied with general constitutional debility, particularly phthysis pulmonalis, and in these cases the pulse is small and frequent. The practitioner has to watch the pulmonary complaint, to prescribe moderate light diet, and to apply blisters to the sternum.

* Syn. L'hypertrophie excentrique: l'aneurisme actif.

† Syn. L'hypertrophie concentrique.

Aneurism of the heart consists in a dilatation of one or more of its cavities, that of the left ventricle being the most common when there is thickness of the parietes, while that of the right ventricle where the parietes are thin, and again that of all the cavities, is the most rare.

In some cases of aneurism, only one ventricle is affected, while in others only one auricle, the left auricle being the one most seldom affected. In aneurism of the right auricle, the tricuspid valve is so diseased by cartilaginous or osseous depositions, as to contract the aperture between the right auricle and right ventricle; in aneurism of the right ventricle, there is generally such a state of diseased lungs as to obstruct the circulation of the pulmonary artery, the semilunar valves of which vessel are rarely affected. In aneurism of the left auricle, the mitral valve is either cartilaginous or osseous, or both; and in aneurism of the left ventricle, the semilunar valves of the aorta are either cartilaginous or osseous. Although the preceding appearances are generally discovered in these various species of aneurism, and may be said to produce them, yet we occasionally find the cause very remote; thus a distorted course of the aorta from curved spine, has been found to produce aneurism of the right auricle and ventricle, particularly that of the former; so also has a contraction of the orifice of the aorta, and of the mitral valve. This dilatation is sometimes accompanied with hypertrophia or increased thickness of the parietes of the cavities.

Aneurism of either cavity, or all the cavities, with thickness or thinness of the parietes, is indicated in its commencement by pains in the region of the heart, palpitations, cough, and oppression of breathing, the latter of which is also short and high: the pulse at this period is little or at all affected. There is a feeling of hot flushings arising from the thorax to the face, which are very tran-

sient; the appetite is keen, and the digestion good, but attended with constipation. The patient is easily fatigued, and an oppressive breathlessness follows, which occurs most frequently on walking up a hill or up stairs. After the preceding symptoms have lasted for a few weeks, the palpitations become stronger and more frequent; the pulse is hard, vibrating, frequent, and sometimes contracted, when there is increased thickness of the parietes of the cavities; while it is soft, tolerably frequent, feeble and easily compressed when there is simply dilatation; the respiration is now extremely difficult, and the patient is compelled to sit and bend the body forwards, resting the chest on the knees, for he cannot breath in a horizontal posture; the cough is hard and frequent, and there is expectoration of viscid matter occasionally tinged with blood, the latter of which is sometimes spit up in a pure state. He feels a numbness which is sometimes followed by syncope, a constriction about the throat like the globus hystericus, and passes restless nights, being disturbed with frightful dreams. The appetite is still good, but the food excites pain and frequently vomiting, and the bowels become rather relaxed. The abdomen assumes the appearance of approaching ascites, the whole surface of the body looks pale and flaccid, but the face is bloated, the lips being of a violet colour. These symptoms are soon succeeded with more alarming ones, the pulsations of the heart are scarcely perceptible, and when felt are very quick; the pulse is small, frequent, unequal, intermitting, and hardly perceptible; the veins in the neck are swollen; the respiration is extremely difficult, suffocation being threatened every moment; there is a dry convulsive cough, with viscid bloody expectoration, or pure coagulated blood; the expectoration is occasionally, however, purulent. There is great debility, and anxiety, and no

hope of sleep, the patient being instantly awakened with delirium; the appetite is gone, and the stools are watery and frequent; there is universal anasarca, and ascites; and the patient either dies insensibly or in convulsions.

It will be readily acknowledged, that it must be exceedingly difficult to ascertain which cavity of the heart is affected with aneurism. Wherever there are the usual symptoms of aneurism of the heart, accompanied with expectoration of blood, a greater degree of breathlessness, more frequent faintings, a serous diathesis, the countenance of a violet colour, approaching to black, with fluctuation of the jugular veins, we may infer that the right cavities are those affected, all of which appearances are easily accounted for on the connexion subsisting between the right side of the heart and the lungs, and this side and the veins of the face and neck. When the left ventricle is aneurismal, the face is suffused with a lively deep red, and the pulse is more affected. But when the disease is well advanced, whatever be the species of aneurism, there is a general bloatedness of the countenance.

In simple dilatation, or aneurism of all the cavities, without either increase or diminution of the parietes, there is an oppression in the thoracic cavity, with the feeling of occasional suffocation; the pulse is full, slow, and soft, and the heart can be felt to contract sluggishly and equally in the thorax. These are generally attended with dropsical and dyspeptic symptoms. This affection is liable to be followed with chronic inflammation of the heart, or dropsy of the pericardium. In aneurism with hypertrophia of all the cavities, there is also oppression in the thorax, the pulse is strong, full, regular, and frequent, the heart pulsates hurriedly and violently, and the countenance is of a violet colour and somewhat livid. In both of these affections, rest, with abstemious diet, repeated

small bleedings, issues in the region of the heart, and attention to the bowels, are all that can be done.

Aneurism of the heart is occasionally accompanied with enlargement of the aorta, and sometimes but rarely with a contracted state of this vessel; in the former case, the symptoms are nearly the same as when the aorta is about its natural size; but in the latter or contracted state of the aorta, there is difficulty of breathing, a tendency to fainting, with an unequal pulse, accompanying the symptoms already enumerated. Towards the termination of the disease, a pain is felt in the region of the diaphragm, accompanied with cough, a languid frequent pulse, and vomiting.

The treatment of aneurism is the same as that for hypertrophia, with which it is often complicated.

A few rare cases have occurred, where there has been found in the parietes of one of the ventricles of the heart, a dilated pouch, lined with strata of coagulated blood, so as to resemble aneurism of an artery, the symptoms and treatment of which are the same as for the preceding kind of aneurism. The parietes of the heart sometimes rupture, without any previous disease, the ventricles being more subject to it than the auricles, and the left more than the right ventricle. This arises from some violent exertion, a fit of passion, an epileptic paroxysm, or in *actu coitus*. This occurs, however, oftener in diseased states of the heart, as aneurism, ulceration, softening of the fleshy parietes, and violent contusions. Sometimes there is only a rupture or laceration of some of the columnæ carneæ of the ventricles, a case of which is detailed by Corvisart, where one of the large columnæ which form the mitral valve was lacerated from its base, so as to float loosely in the left ventricle.

An aperture being found in the septum ventriculorum,

or the foramen ovale remaining pervious, is far from being an uncommon occurrence. Caillot mentions the case of a child eleven years old, where the foramen ovale remained open, and where there was an aperture in the septum ventriculorum large enough to admit the fingers. In this affection, which is termed the blue disease, from the face having a bluish tint, the patient has difficulty of breathing, frequent fainting, convulsive motions, and diminution of vital heat.

The heart has been, in some instances, converted into cartilage, and even ossified to a great extent; Bordenave mentions one case where the heart was almost entirely ossified; Haller details a case where the inferior part of the right ventricle, the valves of the pulmonary artery, the aorta, and the more fleshy parts of the left auricle were ossified; Burns found both the ventricles mere calcareous moulds; Albertini observed the right auricle ossified; Renauldin, in the "*Journal de Médécine*" for January 1806, relates a case, where he found the heart extremely hard and weighty, the left ventricle appeared changed into a real petrifaction, presenting in some places a gravelly appearance, and in others that of a saline crystallization, the columnæ carneæ being enlarged, and resembling real stalactites. The symptoms of this derangement of structure, are strong and frequent palpitations of the heart on the slightest motion: the pulse regular and full in the beginning of the disease, becomes gradually more feeble and intermitting, the breathing is extremely difficult, and attacks rather in paroxysms, obliging the individual to remain constantly in the semi-erect position, and there is great anxiety, much nausea, with frequent vomiting towards the conclusion of the disease. The patient is also occasionally tormented with pains in the abdomen and lower extremities, and there is more or less dropsical effusion.

As previously mentioned, the valvular structure is very subject to ossification; the semilunar valves of the aorta are most frequently affected; next to them the mitral valve; thirdly, the tricuspid; and lastly, the semilunar valves of the pulmonary artery. The semilunar valves of the aorta are sometimes so indurated as to remain touching each other, thus leaving the smallest aperture for the transmission of the blood; and the mitral valve, with its chordæ tendineæ and columnæ carneæ, have been found forming one continued osseous body, only permitting the smallest aperture possible between the auricle and ventricle. In those cases where the semilunar valves of the aorta are affected, the neighbouring portion of the artery is also involved. These states of the valves, as formerly mentioned, are almost always accompanied with aneurism of one or more cavities, so that the symptoms and treatment are the same. Besides these ossified conditions of the valves, they are often affected with a sort of fungous or warty excrescences, resembling cauliflower buds, complicated with other affections of the heart. When the semilunar valves of the aorta are ossified, strong and frequent palpitations take place, the pulse is irregular, undulating, rustling, obscurely trembling, and is often augmented by the force and frequency of the palpitations, the left ventricle being easily filled, but with difficulty emptied.

Polypus in the cavities of the heart seems a very rare disease, for the coagula found in the cavities, and entangled among the valves, are evidently merely the coagulable lymph of the blood after death. Polypus is to be distinguished from these by possessing a more uniform structure, and being free of any red globules. The symptoms of this affection during life, are irregular action of the heart, irregular pulse, and difficulty of breathing;

and they frequently resemble so nearly those of aneurism, as to be with difficulty distinguished. The treatment is almost the same.

Cancer, a tuberculated state, serous cysts, and vesicular worms, are described by a few authors to be found present in the heart. Cancer is peculiar to glandular structure, therefore its existence appears doubtful in muscular texture, unless soft cancer or medullary sarcoma is meant. Tubercles and serous cysts may exist, but it appears very doubtful if worms are ever present. Serous cysts are not uncommon.

The coronary arteries and vein are subject to the same diseases as blood-vessels in general; but ossification of the arteries, and a varicose state of the vein, may be considered the chief and most common affections which attack these vessels. The coronary arteries are sometimes so ossified, as scarcely to transmit enough of blood to nourish the muscular structure of the heart, one of them being obliterated, in which case the heart is unable to propel the blood freely and entirely out of its cavities, thus disposing it to hypertrophia, and even aneurism. The muscular structure of the heart appears pale and flabby in such cases, and is easily torn with the fingers. The symptoms are occasional palpitations, induced by passion, or by making any undue exertion, as ascending a hill or stairs; irregular pulse, sometimes full and strong, at other times weak and intermitting; violent pain in the region of the heart darting along the arms, even to the fingers, accompanied with difficulty of breathing, and a sense of suffocation when the paroxysm is severe. The patient cannot stretch himself so horizontally as in health. The treatment consists in avoiding every undue exertion, in abstracting small quantities of blood at intervals, in keeping the bowels gently open, and living on moderate

diet. A varicose state of the coronary vein not unfrequently accompanies hypertrophy, or aneurism of one or more of the cavities of the heart.

Malformation of the heart, and of the origin of the large vessels from it, is far from being an uncommon occurrence.

In the beginning of these physiological observations, the blood is stated to have two courses from the heart, the one by the pulmonary artery through the lungs, the other by the aorta, throughout the whole system. That which is circulated by the pulmonary artery through the lungs is named the lesser circulation, and when present in the animal, constitutes the double circulation: I shall defer the consideration of this, till I have explained the greater circulation, or that performed by the aorta. All animals, excepting some insects and zoophytes, have arteries.

The aorta, consisting of its three tunics,* proceeds to the different extremities of the body, dividing at different angles in its course, into innumerable branches, according to the organs which these are destined to supply. These branches or arteries branch off sometimes at

* In the opinion that the arteries consist of three coats, at least that they possess a muscular tunic, I am supported by Willis, Bidloo, Lancisius, Nicholls, Ludwig, Haller, Cuvier, Sir Everard Home, Dr. Young, Dr. W. Phillip, and Dr. Hastings. The cellular tunic is found to be proportionally greater in the larger than the smaller arteries, while the latter again exceed the former, in the proportion of their muscular tunic; the larger are therefore more elastic, while the smaller arteries are more muscular. Besides these three tunics, some arteries have an adventitious coat, thus the aorta within the cavity of the pericardium has the serous coat of the heart; without the cavity of the pericardium, some parts of the arch, and all the descending thoracic aorta, have the pleura, excepting that portion which adheres to the vertebræ. The abdominal aorta, and its division into the iliacs, are also similarly covered by the peritoneum. In the neck, the superior and inferior extremities, the arteries are enveloped, together with their accompanying veins, with a strong cellular sheath; the sheath in some places, as in the trunk of the external carotid and the popliteal arteries, being more delicate.

an acute angle, sometimes at a right angle, and at other times at an obtuse angle: the majority being at an acute angle. Organs which are destined to perform their functions rapidly, as the heart, have their arteries branching off at an acute angle, while those that are designed to do their office slowly, as the testis, have their arteries branching off at an obtuse angle. The velocity of the blood is greater, the more acute the angle of ramification is, and the less flexuous the artery is in its course,* also the less that arteries anastomose in the common manner; but the reverse, when they anastomose like the vertebral arteries, to form the basilar artery on the basis of the brain. By this union of the vertebrals, the velocity of the blood is augmented, and apparently to prevent congestion or pressure. In the frog's foot, two currents are observed sometimes to meet in the middle, and hence lose a corresponding momentum, which anastomosis appears designed to prevent congestion, and to afford a freer communication between one part and another. The blood flows with less velocity in the branches than in the trunks of arteries, in consequence of the increasing area of the branches compared with the trunk, the greater friction as it proceeds onwards, and the impinging against the angles of the ramifications; and with less velocity the nearer the angle is to an obtuse angle.

In the living body, when an artery is exposed, it is always seen filled with blood, and if punctured, the blood

* Some arteries are very flexuous, as the coronary arteries of the lips, the arteries of the uterus, those to the testis, those of the large intestines, of the iris, the umbilical cord, the spleen, tongue, stomach, and also the bronchial, carotid, and vertebral arteries. In some of the lower animals, there are other arteries extremely flexuous; thus the sloths have the axillary and iliac arteries dividing into a number of equally sized cylinders, which are very tortuous, and occasionally anastomose with each other. The arteries, when empty, are almost straight, but become flexuous when distended with blood.

flows in an interrupted stream. But although the arteries thus appear already filled, yet at every contraction of the heart they receive a fresh quantity of blood, from two to three ounces being propelled at each contraction of the systemic ventricle. When we press an artery between the fingers, that part of the vessel next, or proximad the heart, becomes turgid, while that distad or most remote, is emptied and flaccid; but on removing the fingers, the blood rushes into the empty vessel. The course of the blood is beautifully seen by placing the web-foot of the frog, or the tail of a fish, or the punctum saliens of an incubated egg, in the focus of the microscope. An artery, when laid bare, is never found collapsed or corrugated, but appears like a tense cord, thus resembling the collapse of the ventricles of the heart. Every fresh quantity of blood propelled into the aorta, gives an increased velocity to the blood in all the arteries of the body, which impulse is observed to occur at a period later, according to the distance of the artery from the heart. During the circulation, there is a dilatation of the arterial tube every where, in consequence of this regular increased quantity of blood from the heart, and this is greater in some arteries than in others; more so in those nearer the heart, than in those more distant. It is this which gives the sensation of pulsation felt by the finger. There is also a lateral dilatation or diastole of an artery, which dilating power gradually ceases from exposure to the air, the coats contracting and at last stopping the flow of blood. This dilatation does not take place in all the vessels at the same moment of time, as is verified at the neck, temple, and wrist; appearing later the greater the distance from the heart. After this partial dilatation, the artery returns to its former state, which constitutes the systole of the artery. Hence the arteries perform a diastole or dilata-

tion, and a systole or contraction, the same as the heart. From what appears by the artery of an amputated stump, jutting forward at every contraction of the ventricles, or by the artery when tied in aneurism, an artery is supposed to be elongated from the systole or contraction of the heart. This, however, only occurs when the artery is much insulated, so as to render the extreme point one of resistance, and to act as an obstacle to the flow of the blood; for this appearance is not evident when a small portion of an artery is laid bare.

The general cause of increased velocity is owing to the increased impulse given by the quantity of blood propelled into the arteries, which is exemplified in hydraulicks. The pulse is caused by the blood thrown into the aorta impelling all the rest of the fluid before it into the arteries, the same effect occurring with water in a leathern tube of a fire-engine, at each stroke of the double pump, and the parabola of the jet being thereby increased. This dilatation is satisfactorily accounted for, on the principle of the arteries being elastic tubes, and possessing greater elasticity in the longitudinal than in the transverse direction. The heart forces more blood into the arteries than it can give out at opposite extremities, therefore the arteries must dilate to make room for the increased quantity of blood; and the quicker the impelling power, the greater will be the dilatation. When the arteries again contract, their elasticity keeps up the flow of blood, till a new impulse is given by the heart, which results from these vessels tending to return to their former collapsed state, like the ventricles of the heart.

These two powers, the action of the heart, and the elasticity of the arteries, seem alone capable of carrying on the circulation; on the same principles as the fire-engine, where the impulse is given by working the pump, and

continued by it and the elasticity of the tubes. But the arteries possess muscular contraction; they are capable of being stimulated, so as to evidence sensibility and motion. That they possess muscular fibres, may be demonstrated on the middle-sized arteries of man, and many other animals. This muscular tunic, I have already observed, is allowed by Willis, Bidloo, Lancisius, Nicholls, Ludwig, Haller, Sir E. Home, Drs. Young, W. Philip, and Hastings. Haller and Spallanzani found the circulation carried on for some minutes in many cold-blooded animals, in fishes, and in the incubated egg, after the destruction of the heart. In fishes, the blood describes three circles in the liver; and in all other parts, excepting the gills, it describes two circles, before returning to the heart. In cold-blooded animals, the circulation continues in the capillary arteries, after the heart no longer propels the blood.* In insects and zoophytes, where no heart exists, the vessels analogous to arteries circulate their fluids. In all the worms having red blood, and which have no hearts, the systole and diastole of the arteries is well marked. In the lumbricus terrestris, where there is no heart, the blood is solely propelled by the muscularity of the arteries. The lumbricus marinus has no ventricle, the blood being propelled by the blood-vessels of the organs of aeration; and in human monsters, where no heart is present, the blood is propelled by the arteries.† When the aortic valves are ossified, the heart contracts sometimes twice for each pulsation of the arteries. Bordenave found the heart in one instance

* Bichat, Recherches Phys. sur la Vie et la Mort.

† See Memoires de l'Academie des Sciences, 1720, par Mery; Memoires de l'Academie des Sciences, 1740, par Winslow; Com. Soc. R. Sc. Gotting. tom. 4, com. 4, Roederer; Trans. Roy. Soc. Edin. vol. 3, Monro; Phil. Transact. 1793, Clarke; Phil. Transact. 1767, Le Cat.; Medico-Ch. Transact. vol. 1, Young; Phil. Transact. 1809, Brodie.

almost completely ossified; Burns found the ventricles mere calcareous moulds, and Renauldin found the left ventricle converted into a real petrifaction, the columnæ carneæ resembling stalactites. These physiologists also found that the circulation in the arteries varied in different parts of the system in many animals, as the palate, lungs, and mesentery. Haller found that the arteries circulated their fluid in a retrograde direction, when cold, fright, inflammation, or wounds occurred, which fact is corroborated by the experiments of Lewenhoeck and Spallanzani. Spallanzani found that the blood flowed in a retrograde direction along the aorta to the heart, when an incision was made into the latter, although the animal, a salamander, was placed perpendicularly, and hence the blood had to ascend. In the same animal he observed that the action of the heart and aorta was seldom synchronous. He found that the velocity of the circulation in the trunk of the pulmonary artery, compared with that in the ultimate branches, was as three to one; while he perceived no difference between the velocity of the blood, in the small vessels on the surface of the gall-bladder, and that in the large arteries. He observed that the large and middle-sized arteries propel their blood during the diastole of the heart. Haller, in his observations on the motion of the heart, says, "Is motus totus in contractione ponitur, qua eadem communis omnium musculorum functio absolvitur;" which, in my opinion, is equally applicable to the arteries. That the arteries possess sensibility, is proved by their being plentifully supplied with nerves, and consequently capable of being excited by stimuli, of which the blood is their natural stimulus.* In many cases of para-

* The only exceptions to this are the umbilical and placentary arteries; both of which have lately been discovered to possess nerves, by that indefatigable physiologist, Sir Everard Home. Phil. Trans. for 1825, Part I.

lytic limbs, no pulse has been felt,* shewing that the arteries, when deprived of their nervous influence, cannot contract to circulate their fluids, and that the heart alone is unable to perform the function of circulation. Sir Everard Home proves from his experiments, that the arteries, like other parts of the body, are totally dependent on the nerves for their capability to perform contractile motion, and hence, that the nerves which accompany the arteries regulate their actions.† That they possess muscular contraction, is proved by their having a muscular tunic; and where muscular fibres exist, they must be capable of action, because if we deny this in one place, we are equally entitled to do it in another. That they evidence sensibility and muscular contraction, is established not only by what I have already advanced, and the numerous other experiments performed by these physiologists and others, but by what may be observed in the face, arms, neck, and breast of the female in blushing, by the local determination of blood in suffusion of the eyes from sand, and by erection of the penis, either from direct irritation, or from the idea of a voluptuous woman in the mind. These latter actions take place in an instant of time, and they cannot be explained on the elasticity of the arteries, or the action of the heart, for the latter in many cases is not increased in its motions. The arteries in these actions must suddenly act, which can only be effected by muscular action. Besides these, there is the state of the arteries in the heads of those animals which shed their horns; the state of the uterine vessels during gestation; the state of the arteries in the secretion of milk, and the growth of tumours; and the state of the arteries leading to inflamed

* See Storer in Trans. Soc. Med. Chir. Know. vol. iii.

† Phil. Trans. 1814.

parts, as the carotid of the affected side in cynanche tonsillaris.

The middle coat of the arteries being muscular, enables us to comprehend how these fibres will assist the action of the heart, and the elasticity of the arteries, and thus render the extreme branches of these vessels less dependent on the heart; for at no period, and in no part of the arterial system, do we find all the fibres either in action, or in a state of relaxation, but some active in one quarter, and others relaxed in another. It is only in this way that we can satisfy ourselves respecting the sudden actions of insulated portions of the arterial system, and account for the occurrence of all those topical congestions and local palenesses: hence the velocity of the blood in some arteries is greater than in others. The arteries, besides nervous filaments, have lymphatics, and numerous vasa vasorum, or very small arteries and veins, on their tunics, two essential agents in muscular motion.

I formerly remarked that the arteries divided at different angles into numerous branches, which again subdivide into smaller arteries, named capillaries, the majority of which terminate in the veins; some, however, join the veins at an earlier period. This termination of the capillary arteries in veins, can be demonstrated on the pia mater of the human brain, on the tail of a fish, on the web-foot of the frog, and the gills of the salamander and frog. Not only in these, but in other animals, this termination or junction of arteries in veins, has been witnessed by many physiologists, among whom may be mentioned Harvey, Lewenhoeck, Bernouilli, Cowper, Malpighi, Hales, Haller, and Spallanzani.

A second termination of the capillary arteries is into exhalants. These either open into some cavity, as the ventricles of the brain, the nostrils, bag of the pleura,

pericardium, mouth, stomach, intestines, gall-bladder, urinary bladder, uterus, vagina, pouch of the peritoneum, and tunica vaginalis testis; or the exhalation takes place in the skin, eye-lids, and tunica conjunctiva of the eye, and sometimes into tubes and true glands; or these vessels terminate by pores or very short channels or canals, as illustrated in the little cells of the cellular tissue, or in the aerial tubes of the lungs. Almost all the membranes of the body secrete an exhalation, as the dura mater, the pia mater, the pleura, pericardium, peritoneum, &c. The simple experiment of Haller, the insertion of an injecting pipe into one of the venæ cavæ, and the propelling of a coloured liquor, which flows into the heart and pulmonary artery, and escapes at the trachea, illustrates this kind of secretion. Another species of exhalation is by lacunæ and true glands.

A third termination of the capillary arteries is in excretory ducts, which carry a fluid different from the blood, and do not return it to the heart. Some carry their fluids into the aerial tubes of the lungs, some into the stomach, others into the kidneys, and others again out at the skin. Neither Lewenhoeck, nor any one else, excepting Bertin, has witnessed the arteries becoming excretory ducts. It is easy, however, by injecting water into the renal artery, to make it flow into the ureter.

The capillary arteries have been also found to communicate with the lymphatics, as described by Caspar Bartholinus, Borrichius, Nuck, Cowper, Walther, and Haller. These terminations and communications of the arteries will be particularly considered under secretion and absorption.

Arteries convey differently-coloured blood, not only in different animals, but even in the same animal; some insects, as the grasshopper, circulate green blood; some

crustaceous animals, as the lobster, circulate white blood, while the vertebral animals circulate red blood. In man, and many animals, the small arteries of the crystalline lens, vitreous humour, and tunica conjunctiva and cornea of the eye, circulate colourless blood. Haller and Spallanzani talk of the red and yellow artery, the latter being merely a continuation of the former, and consequently smaller, and therefore containing less red blood, or having this colour less concentrated.

Arteries pervade every structure of the body, excepting the tunica arachnoidea of the brain and spinal marrow, the epidermis, the nails, the hairs with the exception of their bulbous roots, and the membranes of the umbilical cord. It is presumptive, however, that both in the arachnoid coat, and in the membranes of the umbilical cord, arteries are present, but that they convey colourless blood, for these become inflamed, and undergo other diseased changes.

The arteries anastomose with each other from the crown of the head to the sole of the foot, and particularly about the joints,* but only with their small branches, excepting the vertebrals, which unite to form the basilar artery.

The various causes and agents which we have mentioned as influencing the heart, must also operate on the arteries, from the one being as it were a continuation of the other. The regular as well as the irregular actions of the heart are all indicated either by the motion of this organ felt immediately over its situation, or by the motion of the blood in one of the arteries, as at the wrist or temple, which motion is termed the pulse. This when regular,

* The free inosculation of arteries should be considered by the operating surgeon in aneurism.

beats the same as the heart, a scale of which from birth to old age is given in page 145, and should be well committed to memory. Although that scale may be considered as a standard to regulate generally our conduct, yet the pulse varies exceedingly in different individuals in health. In some persons at middle life the pulse is seldom higher than 40 in the sitting posture, while in others it is never below 96 or even 106; for it varies much according to our position. I am acquainted with a gentleman who enjoys good health, and who has been many years in a tropical climate, whose pulse while in bed in the morning is 90, but whenever he gets up, it rises to 120; and after breakfast it mounts to 140. Dr. Fordyce mentions the case of an old man whose pulse was naturally only 26 in the minute; and a patient in Guy's hospital about 65 years of age had a pulse of only 16 in a minute: such is the discrepancy in the pulse.

The pulse, during any irregular action, as palpitation of the heart, is always increased in number. The pulse varies in size or fullness, according as the distention or diastole is greater in both the heart and arteries, which fullness or largeness is judged of by the impression conveyed to our fingers. It also varies in the time which is employed in the distention or diastole of the artery. When this takes place quickly, it is termed a strong pulse; and when slowly or gradually, a weak pulse. The pulse also varies in point of regularity, the intervals between the pulsations differing in length, which irregular pulse is divided into unequal and intermitting. It is said to be unequal, when for a number of pulsations the pulse beats quickly, and after a while, more slowly for another number of pulsations, forming a regular series, although neither of the series continue the same length of time. The pulse is named intermitting, when it beats in regular succession,

but stops or intermits at times, one, two, three, or more pulsations. These two latter, the unequal and intermitting, are occasionally combined, nay all of these varieties are sometimes variously combined.

The quick pulse may depend on increased sensibility and motion of the heart, from any cause that increases the frequency of the contractions of the heart. It may also depend on the stimulant power of the blood; and likewise on an increase of the velocity of the flow of the blood in the veins.

The slow pulse is caused by moderate diminution of the sensibility and motion of the heart, by diminution of the stimulant power of blood, and by less velocity in the flow of the blood in the veins.

As the arteries themselves possess a structure similar to the heart, evidence similar phenomena, and are capable of being influenced by the same causes, they must assist in producing these effects, or, in other words, they must aid in rendering the pulse quicker or slower.

The varieties in fullness of the pulse is caused by a greater quantity of blood being present in the artery when distended, which may be produced by an increase in the quantity of the blood sent from the heart, or by a greater velocity being given to this blood. It may also arise from more blood being present in the artery, when a fresh supply is propelled from the heart; or when there is plethora in all the arterial system, which plethora, however, may be partial, and confined to particular parts. The pulse is rendered fuller by the same means that it is rendered quicker, namely, the increased action of the heart, the increased stimulant power of the blood, and an increase in the velocity of the blood in the veins. It may be also rendered fuller by any impediment to the flow of the blood in the arteries.

Small or slender pulse is necessarily caused by the reverse of what produces fullness of the pulse.

The varieties in strength and weakness of the pulse depend on the combined action of the heart and arteries; which varieties depend chiefly on the difference of time the arteries take in being filled, and less on the action of these vessels; and by ascertaining the time which the artery takes in being filled, we can calculate the quickness of action of the ventricles of the heart.

The intermitting pulse appears to be caused either by no blood, or so little being sent from the ventricles, that it produces no dilatation in the arteries to render a sensible impression on the fingers. This may depend either on no action, or too weak an action of the ventricles, or it may depend on a sudden spasm preventing their receiving any blood from the auricles, or upon such an obstruction between the auricles and ventricles, or between the ventricles and arteries, as to prevent their receiving a sufficient quantity of blood.* Polypus, or ossification of the tricuspid, mitral, or semilunar valves, or aneurism of the arch of the aorta, produces nearly the same effects.

Too small a quantity of blood leaving the heart, seems to be the most frequent cause of intermission of the pulse. This frequently occurs where the heart is quite healthy, as in those having weak stomachs, which are often disordered, and in nervous people. In the nervous habit, it must depend on too feeble action or spasm of the heart. Immediately after intermission, there generally takes

* In Medico-Chirurgical Transactions, vol. i. Mr. Abernethy details two cases, where the communication between the left auricle and corresponding ventricle was so small, as to impede the flow of blood: the auricle was double its size, and the ventricle smaller than natural. The pulse was extremely small and frequent in both. I examined the heart of a middle-aged lady, where the same appearances were found, and where the pulse was during life also exceedingly small and frequent.

place an increased effort of the heart, which causes a greater action.

The arteries seem to possess a power inherent in themselves of acting, without calling into action the heart, the contractions of which continue naturally the same; and in this independent action the veins participate. This independent action of the arteries is ascribable to the nerves, for all motion begins in the latter. This phenomenon is beautifully elucidated in the eye, where the transparent, almost invisible vessels, on the tunica conjunctiva, become, from any exciting cause, red in a few seconds, by immediately enlarging. It is illustrated by the act of blushing in the young female, where the face, neck, bosom, and arms, become in a moment suffused; by the application of hot water, or a heated metal, to a small part of the face, instantaneously producing redness; and by the penis being injected immediately with blood, from local irritation, even in sleep. The application of cold produces a similar appearance; the nerves are chilled, causing a suspension of their action, at the same moment that the capillaries are constricted, thus increasing the resistance; so that the nerves are excited, and the arteries are immediately after overcharged. In these actions, the arteries are excited to contract with more vigour and celerity, and consequently propel the blood with more quickness, and in greater quantity, than ordinarily.

When this action lasts for any time, it is named a local determination of blood;* but when pain accompanies it, it is styled inflammation. In the latter, the nerves are excited to greater action, and the contractility of the arteries is soon by over-action enfeebled, so that these

* A local determination of blood increases the bulk of the part, by depositing new substance.

vessels enlarge and circulate a greater quantity of blood. The blood, however, appears to flow with increased velocity, which is caused by that part of the artery immediately contiguous, or leading to the inflamed and dilated portion, being morbidly excited. The artery of an inflamed part, therefore, is at first smaller than during health, in consequence of the spasmodic action of the nerves, and the distention of the vasa vasorum, diminishing the calibre of the vessel, but very soon becomes enlarged, from the nerves being partially exhausted, and the vessel over distended with blood; while the portion leading to the inflamed part is contracted in diameter. The increased quantity of blood circulating in an inflamed part, is the cause of the redness, and partly the cause of the increased heat. Nearly the same effects take place, only in a less degree, in local determination of blood, or what is sometimes styled congestion; for when the capillary arteries are partially constricted or obstructed, inflammation may supervene.

In inflammation of any degree, the heart and the whole circulating system are involved, and constitute inflammatory fever; sometimes the quickened pulse precedes the appearance of the inflammation, while at other times it follows. In the former, the increased circulation, from whatever cause, so excites the nerves and arteries, that they are incapable of returning to their wonted quiescence, and the inflammation may be either partial or general, according as there is any part of the body feebler than another. This is satisfactorily verified in those who have once had any local inflammation, having always that part attacked more readily than any other, in any increased action of the heart and arteries. In the latter, or when the quickened pulse follows the inflammation, the heart and arteries are excited by the diseased action of the

nerves of the part being transmitted along the nerves to the heart.

The treatment of local inflammation is by leeches, or cupping, warm anodyne fomentations, and poultices:* applying the leeches in great numbers, and repeating the fomentations and poultices, as often as they become cool.

The treatment of general inflammation is by general blood-letting, warm-bath, or warm sponging, saline purges, acidulated drinks, low diet, and perfect quietness in a darkened or dark chamber. The blood-letting, at the onset of the disease, should be carried to syncope, and repeated every four hours till the pain is removed, for this symptom is the most to be depended on, and is the best criterion of this case; the pulse and buffy blood† may almost be thrown out of consideration. The warm-bath, or sponging with warm water, should be repeated as often as the skin indicates preternatural dry heat. Salts ought to be given much diluted, and often enough to produce two motions in the twenty-four hours, while pain is present, and one daily when this is subdued. The acidulated drinks may be made of super-tartrate of potash, tamarinds, or green fruits. Low diet is vegetables plainly boiled, green fruits, and plain cold or toast-water. From what has been said, it will be at once understood, that the local inflammation may become general, and require the combination of these treatments.

* Sir Everard Home's experiments on the influence of the nerves upon the arteries, incontestably prove the superiority of warm applications over cold, to inflamed surfaces.—Philos. Trans. 1814; see also Dr. Wilson Phillip, in Philos. Trans. 1815; and Le Gallois sur la Principe de la Vie.

† Many a patient is made a victim by the practitioner giving too much weight to buffy and cupped blood. This appearance depends on increased absorption, therefore it is more exhibited at the last scene of life, than in the beginning of disease.

In inflammation of almost any degree, the capillary arteries are modified by the nerves, to secrete coagulable lymph, which generally favours the inflammatory action by moderating it. When this action is more violent, the capillaries are modified by the nerves, so as to form small papillæ, named suppurative, which secrete purulent matter; and when the inflammatory action is extremely violent, the nerves, arteries, and contiguous textures, are so destroyed in their structure, the two former by inflammatory exhaustion, the last both by this and by being gorged with blood, which coagulates, in consequence of not being kept in motion: this constitutes gangrene, or mortification; sphacelus being the further stage, or separation of the gangrened part. These are the common and general terminations of inflammation; the first, or the secretion of coagulable lymph, which generally accompanies a natural quiescence of the inflammatory action, is termed resolution, although resolution may take place without effusion of coagulable lymph. When coagulable lymph is thrown out, and becomes a bond of connexion, as in pleuritis, the termination is named adhesion; the capillaries shoot into the lymph, and render it an organised mass: and when lymph is effused into a recent wound, and becomes a similar bond of connexion, it is termed union by the first intention; the capillaries here performing the same part as in the former. The second termination, or the secretion of purulent matter, is named suppuration; and the third, or destruction of the different textures inflamed, is denominated mortification. Besides these, there are other terminations. When the suppurative papillæ are exposed by rupture and absorption of the integuments, the disease is named ulceration, of which there are many varieties, depending either on local circumstances or on constitutional causes. Ulceration may also take place in cavities, as in the thorax; in

which case there are ulcerative papillæ, or the suppurative papillæ perform what is named the ulcerative absorption, *i. e.* the papillæ secrete pus, while the absorbents are excited to remove the contiguous structure, so that there is active absorption and secretion going on. When inflammation attacks the serous membranes, as the pleura or peritoneum, the exhalants are sometimes rendered so debilitated, that they secrete more than their natural quantity, and of a more watery consistence, which constitutes effusion or dropsy. This disease may also be caused by diminished absorption, or by both increased exhalation and diminished absorption. When this action attacks glandular structure, the arteries secrete a peculiar condensed cartilaginous structure, named schirrus, or carcinomatous sarcoma, which, when accompanied with pain, forms occult cancer. The capillaries in various parts of the body, and in various textures, secrete differently diseased substances, forming a variety of tumours, as tubercles, the common vascular or organised sarcoma, the adipose sarcoma, the pancreatic sarcoma, the mammary sarcoma, the tuberculated sarcoma, and the medullary sarcoma, or fungus hæmatodes; also the different kinds of encysted tumours, as the steatoma, melliceris, and the atheroma.

When suppuration follows active inflammation, and the matter is confined by the surrounding parts, it is named an acute abscess; a free incision should be made to evacuate the fluid, and the part afterwards treated with simple dressings, or lint spread with simple ointment, and bandage. If the suppuration has been extensive, nourishing diet, and, as soon as possible, exposure of the patient to the open air, will be requisite. As the part becomes ultimately an ulcer, I shall defer saying any thing

further until I come to the consideration of the skin. When suppuration is slow in its progress, and preceded by chronic inflammation, which is merely a slow action of the inflamed vessels, in this case, a small opening should be made with a lancet, the wound either healed up, as directed in page 121 of Part V., or allowed to remain open, and the parts properly supported by compresses and bandage. Nourishing diet, and exposure to the open air, are powerful auxiliaries in the cure.

In mortification, the application of simple warm poultices is far preferable to stimulants, for the gangrened part cannot be saved, but must sphacelate; so that our object is still to subdue the contiguous inflamed part, and thus prevent a further extension of the gangrene: consequently, the low diet, gentle laxatives, and acid drinks, should be continued, unless diarrhœa is present, when the latter should be given up, and astringents administered. When sphacelus is perfectly established, the part may be removed, but not too near the gangrened surface. In extensive gangrene, as that of a limb, arising from external injury, amputation is proved to be salutary.* The treatment of the other terminations of inflammation will be detailed when we come to the structures they affect.

When any obstruction takes place in an artery, either from coagulated blood, pressure, or the application of a ligature, the limb does not die for want of blood, because the circulation is carried on, however feebly, by the anastomosing branches: the latter gradually enlarge, until the communication between the upper and lower parts of the

* Mehee, Traité des Plaies d'Armes à Feu, Paris, 1799; Larrey, Memoires de Chirurgie Militaire, tome iii.; Lawrence, Medico-Chir. Trans. vol. vi.; A.C. Hutchinson's Practical Observations on Surgery; Mathews, in Edinburgh Medical and Surgical Journal, vol. xix. p. 205.

limb is completed. The blood, in the first part of this process, stimulates these anastomosing branches, next gradually enlarges them, and lastly, by this increased determination, gives them proportionate strength. The vessels appear to be modelled to perform their new and more important task.* Sometimes, however, these anastomosing vessels are incapable of carrying on the circulation sufficiently, and the limb dies from mortification.

When an artery is secured by a ligature, the two internal, or the serous and muscular coats, are either partially or completely cut through, while the external or cellular coat remains sound; a moderate degree of inflammation is next excited, coagulable lymph effused, and union of the opposite sides of the artery effected by adhesion. Sometimes, however, instead of this healthy termination, the inflammatory action is too violent, and ulceration occurs, which is followed by hemorrhage. The serous coat of an artery is the most easily inflamed, and the most subject to disease. When injecting a limb in the dissecting-room, great care is requisite to avoid rupturing the serous and muscular coats, and to prevent the injection flowing into the mesh of the cellular tunic, or into the cellular or muscular substance in the contiguity.

When an artery is obstructed by the internal or serous coat separating and plugging up the calibre of the vessel, or from coagulated blood, the vessel above this obstruc-

* Cases are detailed where the aorta has been obliterated, and yet the circulation carried on by the other vessels. See Stanzel's Dissertation de Steatomatibus Aortæ; Meckel, in the Memoirs of the Royal Academy of Berlin, for 1756; Stoerk, in Medical Annals, vol. ii.; Dessault's Medical Journal, a case by Paris, tome ii.; Medico-Chirurgical Transactions, vol. v. a case by Dr. Graham. Sir A. Cooper tied the aorta first in the dog, Medico-Chirurgical Transactions, vol. ii., and then in the human body; the man lived for several hours after, Surgical Essays, vol. i. See also a case by M. Crampton, surgeon-general at Dublin, in Dublin Hospital Reports, vol. ii.

tion either dilates or ruptures, and produces aneurism. In the case of the artery simply dilating, either from the preceding causes, debility of its coats, an undue impulsion, or any other cause, the disease is styled true aneurism;* which species is most frequently met with in the arch of the aorta, and occurs likewise in the thoracic and abdominal portions, at the division of the carotid and the iliac arteries, and also in the arteries of the brain. But this is not properly considered true aneurism, which is a disease consisting of a dilatation of the coats forming the sides of an artery; the present affection being a simple dilatation of an artery, and when it occurs in the ascending aorta, the coats are thickened and covered with atheromatous and calcareous depositions. The symptoms of this dilatation of the commencement of the aorta are the same as those of aneurism of this part, and so also is the treatment. But this is a species that seldom occurs, for the internal or serous coat, together with the muscular, rupture in consequence of their brilliancy, or from inflammation and ulceration, or mortification, or partial dilatation; or absorption of these two tunics takes place, in consequence of some diseased spot, which appears of a blackish colour, and slightly inflamed,† while the external or cellular coat alone is dilated, constituting what is named by some writers true, and by others false aneurism. When the cellular coat of the artery is ruptured, the blood is then only confined by the loose cellular sheath of the artery, which also yields; the walls of the sac are then formed by the surrounding parts, which have been con-

* Morgagni, Pelletan, and Larrey, are of opinion, that syphilis is a predisposing cause of aneurism.

† In many subjects brought into the dissecting-room, where an aneurism was present, these black spots or tubercles have been found in many arteries. They appear to be an effusion of blood from the vasa vasorum.

solidated by the previous inflammatory action excited by the distention of the tumour. The sac, however, sometimes bursts before these adhesions are sufficiently strong, and the blood is injected among the surrounding soft parts. When the aneurism advances to the skin, the integuments slough and ulcerate, and the patient dies of hemorrhage; the same process takes place in the trachea, œsophagus, stomach, and other mucous structures; while, when an aneurism bursts through a serous membrane, as the pleura, the latter is lacerated. When an aneurism presses upon a bone, the latter becomes carious. In the event of the cellular tunic of the artery rupturing, and the blood diffusing itself in the contiguous cellular substance, the disease is denominated by some simply false aneurism, and by others diffused false aneurism, to distinguish it from the preceding, which is then named the circumscribed false aneurism. This false aneurism, or diffused extravasation of blood, is more generally produced by an artery being wounded with a sharp pointed instrument, so that the blood escapes at once into the surrounding soft parts.* The parts of the arterial system most subject to the second species of aneurism, or that wherein the serous and muscular coats are ruptured, and the cellular dilated, are the arch of the aorta, the external carotid artery, the axillary, the brachial, the femoral, and the popliteal arteries. The symptoms of this disease, when it attacks the arch of the aorta, are, difficult, frequent, laborious, and whistling respiration, the inspirations appearing never to be complete, thus

* The opinion of the majority of surgical writers of the present day, is, that true aneurism consists of a rupture of the serous and muscular, with a distention of the cellular coat, and that this rupture takes place in the side of the artery. In aneurisms of some magnitude and continuance, however, I have seen the whole area of the artery involved, and the serous coat distributed in patches over the tumour.

resembling those in asthma, and also occurring in paroxysms, particularly when walking, on which occasion there is frequently a sense of suffocation; frequent cough, with occasional expectoration of mucus streaked with blood; pain at the sternum; intermitting pulse, which, however, is sometimes very variable, being occasionally soft, full, and frequent, and different at the two wrists; face more or less livid; the extremities ædematous; and the patient unable to lie on the back in the horizontal posture. When percussion is employed, the thorax does not sound on the middle and upper part of the left side; and when the hand is applied, a rustling and trembling is felt. This disease is often mistaken for an affection of the lungs; and I have seen it mistaken for hydrothorax. In some cases, the tumour presses outwards, and generally on the left side of the thorax; one instance of which occurred in a woman, representing the appearance of two mammæ on one side. I took a drawing of the case, and have preserved the preparation in my Museum. The treatment of this fatal malady can only be palliated by occasional bleedings, low diet, gentle exercise, and attention to the bowels. A tangible aneurism, if I may use the expression, is characterized by a pulsating tumour in the region of an artery, with the pulsation of which it corresponds, attended with pain in the seat of the tumour; and when in the lower extremity, feebleness and pain in walking. When in bed, the patient is attacked with cramp, and sudden twitchings in the legs, which prevent him sleeping. The tumour, when examined, contains arterial blood, generally partly fluid, and partly in layers of coagula; it is only in those small true aneurisms, that the blood is entirely fluid. Patients are frequently affected with more than one aneurism, showing that there is a general affection of the arterial system. This species may be treated either by

compression or an operation; if the former be adopted, sponge as a compress, with a bandage rolled from the distal to the proximal end of the extremity, will be found the best. For a detail of the operations to secure the different arteries, the reader is referred to Parts II. and III., where each is minutely described.

Besides these diseases, arteries are subject to inflammation and its terminations, as adhesion, suppuration, and gangrene; and are also frequently involved in inflammation, and other diseases of contiguous structures. The internal or serous coat is sometimes found of a deep-red colour, with a deposition of coagulable lymph, appearances which have been witnessed in the aorta in severe cases of pneumonia, carditis, and bronchitis. In some cases, the cellular membrane connecting the coats of the aorta have been found distended with lymph. The application of a ligature to an artery in amputation, or for the cure of aneurism, has occasionally produced so great a degree of inflammation as to extend to the heart. The ligature on the umbilical cord sometimes excites inflammation along the hypogastric or umbilical arteries. The arteries are not unfrequently deeply tinged, of a red colour, from transudation of the blood; but when the internal or serous coat is detached, the muscular presents no unnatural colour, there is no deposition of lymph, and no thickening of the coats of the vessel. As this state of the arteries is a concomitant of other acute diseases, the practitioner is directed to their symptoms. Should he suspect inflammation of the artery, or arteries, the antiphlogistic treatment will require to be more vigorous.

In the vicinity of ulcerations, thickenings, or calcareous depositions of arteries, the vessel is generally inflamed, which must be considered chronic; the internal coat of the artery is of a deep red colour, and is softer and thickened.

This condition of arteries occurs commonly in aneurismal subjects, whose diseased state of the arteries is complicated with syphilis. The effusion of coagulable lymph and the adhesive inflammation, have already been considered; but I may here observe, that Nature, with her infinite wisdom, has by this process preserved the lives of many for several days, as in phthisis pulmonalis, where, when the substance of the lungs is nearly entirely consumed, hemorrhage is prevented by the closure of the branches of the pulmonary artery, through the means of effusion of coagulable lymph, and the adhesive inflammation; but where the ulceration is so rapid, as to prevent this adhesive process taking place, hemorrhage ensues, which becomes more or less serious, according to the magnitude of the artery.

Suppuration is seldom witnessed, in consequence of the matter being washed away by the blood; but ulceration is often met with in arteries affected with calcareous and atheromatous depositions. This condition of arteries frequently gives rise to aneurism, to apoplexy, hemoptysis, hematemesis, &c. This state often occurs in phagedenic ulcers.

Gangrene of a limb involves the arteries, together with the other textures, but inflammation of an artery seldom or never ends in gangrene.

The serous coat of arteries is sometimes converted into cartilage, sometimes into a thickened pulpy structure, like steatoma, sometimes into an atheromatous substance, which is however deposited between the serous and muscular tunics.

Ossification of the arteries, or a deposition of calcareous matter, is a very common result in old age; sometimes, however, it occurs in very early life, even at fifteen months. All the old subjects which come into dissecting-rooms,

have their arteries from the aorta to the arteries of the brain, arm, and leg, covered with calcareous depositions, which begin on the outer surface of the serous coat. This change of structure is the most common cause of spontaneous aneurism, and is a frequent cause of apoplexy, hemoptysis, and mortification of the inferior extremities. Calcareous depositions take place principally in the arteries of the trunk, in the branches of the carotid and iliac arteries, and more frequently in the second and third orders of arteries, than in their ramifications. The pulmonary artery and valves are seldom affected; and the upper extremities much more seldom than the lower. In maniacs, the arteries of the brain are generally ossified.*

Hemorrhage from a wounded artery is to be stemmed by various methods, which vary according to the magnitude and number of the vessels injured; but it may be laid down as a law in surgery, that wherever an artery is large enough to pour out such a quantity of blood, as to weaken in the least the patient, it should be secured by a ligature above and below the seat of the wound. Where a vascular surface is wounded, in which the blood-vessels are extremely small, where they are merely capillary, as, for example, the mucous membrane of the nares, styptics, with compression, and a bandage, where it can be applied, should be employed. The styptics used are cold water, vinegar and water, a solution of the sulphates of zinc, copper, or iron, the mineral acids diluted, alcohol, alcohol and sulphuric acid combined together. In all contused wounds, where arteries are injured, compression should be used, and if found ineffectual, the artery leading to the injured part should be secured by ligature, but never at the seat of the injury. This is well exemplified

* Marshall on Mania and Hydrophobia.

in the palm of the hand and the sole of the foot. Compression is produced by lint, dry sponge, sponge-tent, agaric, and bandage, and is the remedy employed in hemorrhage of the plantar or palmar arteries, the internal pudic artery in lithotomy, the intercostal arteries, the temporal artery, and the extreme branches of the internal maxillary artery, after the extraction of a tooth. The actual cautery is employed after the extraction of tumours from the antrum maxillare, the gums, palate, &c. When hemorrhage occurs in any of the large cavities, as the cranium, the thorax, and abdomen, the patient is treated with bleedings from the arm to produce syncope, with depressing narcotics, as digitalis and hyosciamus, together with gentle laxatives, low diet, and perfect rest. When the cranium is the seat of the hemorrhage, we often trepan in the region of the middle meningeal artery, in the expectation that it is the source of the hemorrhage. When in the thorax, we can only have recourse to the general remedies mentioned; but when in the abdomen, if the vessel be conjectured to be so large as to endanger life, which may be calculated to be the case, by syncope becoming more and more alarming, we ought to lay open the cavity, and secure the wounded vessel; "satius est enim anceps auxilium experiri quàm nullum."

Hemorrhage has proved fatal even from the gums, or the nares: when from the former, it has been after the extraction of a tooth, and then sponge-tent, wedged between the contiguous teeth, and the jaws firmly bound together by a roller, will stem the bleeding; when from the nares, the hemorrhage may be stemmed by plugging up the anterior and posterior apertures of the nostrils with lint. Hemorrhage proves sometimes fatal in rapid ulceration involving large arteries.

The greater number of animals have veins, at least all those which possess a heart: veins, therefore, are only observed to be deficient in insects, as the erucæ, and in zoophytes, as the polypi. Veins are also sometimes found deficient in the human monster, when born without the heart.

In page 177 we remarked, that the capillary, and even some of the larger arteries, terminated in, or joined the veins; that this junction can be demonstrated on the pia mater of the human brain, the tail of a fish, the web-foot of the frog, and the gills of the salamander and frog; and that this inosculation had been witnessed not only in these animals, but in others, by several physiologists, as Harvey, Lewenhoeck, Bernouilli, Cowper, Malpighi, Hales, Haller, and Spallanzani. When cleaning out the arteries of a limb, or the head of a subject, with tepid water, previous to injecting it with coloured wax, the water returns by the veins; and when injecting the arteries of a limb, or the head, with the coloured wax, the veins are often found filled. If a ligature be applied to a vein, or if pressure be made, as in blood-letting, the distal parts become turgid, while the proximal, or those next the heart, are found empty; so that there can be no doubt, that the veins return the blood from the arteries to the heart, and that they circulate their blood from extremes, or branches, to trunks: this latter observation is applicable to all the veins, with the exception of the vena portæ, which when it approaches the liver, branches from a trunk like the arteries. That some veins commence by open mouths, and perform the function of absorbents, is still doubtful; for although there are many experiments related by Haller, Magendie, and others, which seem to substantiate this opinion, yet they can all be satisfactorily explained by the acknowledged fact, that the veins and lym-

phatics have a direct communication. Where the veins have been found to be absorbents, they may have received the fluid through the medium of the lymphatics, either in the living, or in making mercurial preparations in the dead state.

The veins begin by small branches continuous with the arteries, and have numerous inosculations as they advance and become larger, even in their largest trunks. The veins of the lower extremities and abdomen form the vena cava ascendens, which enters the right auricle, along with the vena cava descendens and the coronary vein, the former of which returns the blood from the head and upper extremities, while the latter returns it from the heart. The anastomoses of the veins differ from those of the arteries, the former taking place even in the larger trunks, the latter only in their smaller branches; and by the blood thus concentrating in the veins, it flows with more rapidity. The veins take various courses; some accompany the arteries, as the venæ satellites of the arteries of the extremities; others run between the skin and the muscles, as the cutaneous of the extremities; others abandon the arteries, the blood of which they return, as the sinuses of the brain: others again form several separate plexuses, without accompanying the arteries, as those of the neck, tonsils, spermatic cord, urinary bladder, and vagina. The veins vary in the thickness of their sides, those running immediately under the skin being the thickest, while those in the abdomen are the thinnest, with the exception of those in the sinuses of the head. This variety of thickness seems to depend on the pressure applied to the veins, those vessels being thickest where little or no pressure exists, as the subcutaneous. The veins, like the arteries, have three tunics, but considerably thinner, namely, a cellular, a muscular, and a serous; the first and last, like the

arteries, are allowed by all, but the middle or muscular is doubted, and particularly its muscular contractility; flexile muscular fibres, however, can be demonstrated running longitudinally on the venæ cavæ in man, and many other animals, which fact is taken notice of by Lancisius, Borelli, Senac, and Haller; the last of whom observed these vessels pulsate and contract in propelling the blood into the right auricle, both in cold and warm-blooded animals, which latter circumstance was also noticed by Lancisius, Senac, Steno, Lower, Cowper, and a number of anatomists. The fact that the blood circulates in worms of red blood, that have no heart, and that the umbilical vein of the fetus, both in the perfect fetus and in the monster without a heart, circulates its blood, satisfactorily prove that veins possess muscular contractility. They have nerves, lymphatics, arteries, and veins, the same as the arteries. The veins have no adscititious cellular covering, or circular muscular fibres, and although much thinner, yet they have greater density and strength than the arteries, being sometimes prodigiously dilated with blood, and afterwards returning to their wonted calibre. In the dead state, they are less easily ruptured by the distention of injections than the arteries. In old animals, however, the veins have less density and specific gravity than the arteries. In some parts of the body, as in the sinuses of the brain and in the bones, the veins consist only of their internal or serous tunic.

When a vein is opened, we observe the blood flow in jets, shewing that the impulse of the heart is even communicated, to a certain extent, in the venous system. Hales and Walæus observed the blood accelerated in the capillary veins, at each systole of the heart, in cold-blooded animals; but Haller found that this did not take place in warm-blooded animals. The increased flow of

the blood into the veins appears consequent on the action of the heart, communicated through the medium of the column of blood in the arteries; but the blood is moved forwards in the veins, partly by the action of the heart, partly by the elastic and muscular powers of the arteries, and partly also by similar powers in the veins. These powers of elasticity and muscular contractility are much feebler in the veins than in the arteries, in consequence of their more delicate structure.

As certain portions of the body tend to induce congestion in the veins, as the action of the muscles in the extremities, Nature has, with her infinite wisdom, placed a number of valves in these vessels, and these are consequently found most numerous in the veins of the extremities. Valves exist also in the veins of the neck and head, but they are deficient in the brain, those in the sinuses having merely little productions of the membrane stretching across; and they are also deficient in the vertebral veins, in the pulmonary veins, in the coronary vein of the heart, with the exception of a single valve at the termination of the latter in the viscus, in the veins of the portal system, in those of the urinary bladder, in those of the uterus, in those of the kidneys or supra-venal glands, in the placenta, or umbilical vein, though the latter has some rugæ. These valves, which are of a sigmoid shape, as represented in *Fig.* 3, Plate III. Part II., vary from one to three in number, one being only found in the smaller, as in the veins of the hand, foot, spermatic cord, and vena azygos, and one at the termination of the vena cava inferior, named after Eustachius, and one at the coronary vein. Two valves are found in the majority of the veins, and three where the larger veins unite, as at the junction of the crural veins, and that of the internal jugular with the subclavian vein. These valves are formed by a pro-

duction of the internal or serous tunic, and have a shining and somewhat tendinous appearance, that portion adhering to the wall of the vein being in some degree callous; and they have their free edges pointing to the heart, or proximad. They seldom form a complete partition, but oppose a considerable obstacle to the reflux of the blood.

The valves of veins seem to be designed to obviate pressure, and hence they are found in the veins of the extremities, and in those returning the blood from the testis and ovarium. These valves consequently prevent muscular contraction from retarding the flow of the blood, and by their directing the course of this fluid, the muscles rather increase than diminish, by their motions, the velocity of the blood. These valves evidently answer the same purpose in the subcutaneous veins, for there they are constantly exposed to the pressure of the skin. The blood is propelled in the veins of the mesentery, &c. by the action of the abdominal muscles, and in the lungs by the motion of respiration, hence no valves are requisite in these regions. Veins have their vasa vasorum and nervous twigs like arteries, and are much more sensitive. In some places the veins are more dilated than in others, as in the vena cava inferior sacrad to the diaphragm, the beginning of the internal jugular, and the popliteal vein between the condyles of the os femoris.

The blood is found to flow faster in the trunks than in the branches of the veins, which must depend partly on a law of hydraulicks, that a fluid flowing from a larger into a smaller tube, is augmented in velocity, and partly on the principle that it flows in larger vessels possessing stronger muscular fibres. Hence, when a small vein is opened, the blood flows very slowly, but more quickly from a larger vein, and with still more rapidity from a

venous trunk. The flow of the blood in the veins is observed to be more rapid the greater the number of uniting branches, and the shorter these are, because they are less tortuous. The less veins anastomose, and the less the angle at which they meet in anastomosing, the more is venous congestion prevented: but these anastomoses of veins enable the blood, when impeded in one course, to flow by another onwards to the heart.

The blood in the veins flows quicker, the more rapidly the arterial blood flows; and it is agreed, that in vessels of the same size, the blood flows slower in a vein than in an artery, in consequence of the propelling powers being diminished by the friction of the blood against the sides of the vessels, and its adhesion to these sides; and also, in consequence of the feebler structure of the veins.

Veins are not only greater in diameter, but thrice as numerous, as the arteries; the area of the whole venous system is found much greater than that of the arterial; that of the veins is calculated to be to that of the arteries, as nine to four, which is easily comprehended by the great number of middle-sized veins, and by the excess of veins over the arteries, as, for example, in the upper extremity. Much greater variety occurs both in the division and in the origin of the branches of the veins than in the arteries.

When the body is exposed to caloric, the blood passes readily into the veins, apparently from the expansion of the capillaries, and the increased impetus given to the circulation of the heart; on the contrary, when exposed to cold, the capillary vessels are contracted, and the blood circulates more slowly.

When a ligature is thrown round a vein, its coats are merely applied to each other; they are not ruptured, like those of an artery, consequently more irritation is produced, and inflammation excited: and as the action or mo-

tion of veins is the reverse of that of arteries, being from extreme branches to the heart, and the blood flowing in the same direction, the inflammatory action frequently extends to the heart and proves fatal. It is now therefore an axiom in operative surgery, never to apply a ligature to a vein, even in amputation, but to trust to compression. Dry sponge, with proper bandaging, is found capable of stemming the hemorrhage from the largest veins.*

If a fine or thin ligature be employed, the internal tunic is lacerated, inflammation produced, and if compression be applied, so as to retain the opposite sides of the vein in contact, adhesion takes place.

Veins are very prone to inflammation from wounds, as in blood-letting, particularly where there is any tendency to erysipelas, and in sultry weather, and especially in crowded and filthy hospitals. The inflammatory action extends along the vein onwards to the heart, and very frequently proves fatal. The vein, where punctured, is thickened in its coats, and for some extent onwards towards the heart; in some places the internal tunic is of a deep red colour, onwards to the right auricle; in other places it is lined with coagulable lymph, and in others again with pus. The vein is frequently found obliterated in places. The cellular substance in the contiguity of the vein is often in-

* There are numerous cases on record of the fatal effects of tying veins; in Travers' Surgical Essays, Part I.: Carmichael, in Transactions of the Association of Fellows of the King and Queen's College of Physicians in Ireland, vol. ii.; Abernethy's Works; Loguet, Dissertation sur l'Inflammation des Veines, Paris, 1815; Hodgson on Diseases of Arteries and Veins; Hunter, in Transactions for Improvement of Medical and Surgical Knowledge, vol. i.; Breschet, Traité des Maladies des Artères et des Veines; Surgical Essays by Sir Astley Cooper and Travers. Meckel and Osiander detail cases where the tying the umbilical cord proved fatal. The same event I have witnessed myself, where the inflammation and suppuration extended onwards to the liver of the child.

filtrated with pus, so also occasionally is the pectoral muscle. The symptoms of this disease are pain in the wounded part, extending along the extremity with great tumefaction, severe pyrexia, small quick pulse, hot skin, difficult respiration, furred tongue, great prostration of strength, with pain in the head, back, and extremities. The treatment consists in active blood-letting from the system, warm bath, laxatives, low diet, and rest, accompanied with leeches, hot anodyne fomentations and poultices applied to the arm. Abscesses often occur in the course of the vein, and require to be early punctured.

The crural veins have occasionally been found inflamed and filled with purulent matter, after accouchement; and the hypogastric and spermatic veins, onwards to the renal veins, have been found in the same state in puerperal fever, and after abortion.* One or more veins in the body have been found in a similar condition in phthisis pulmonalis, in cancerous states of various organs, and in erysipelas.† Veins have been found inflamed from metastasis.‡

Ulceration occasionally begins in the interior coat of a vein, and ulcerates through the vessel, so as to give rise to hemorrhage.§ Veins have been found ruptured without ulceration, or any morbid change, being easily torn when suddenly distended, as in cramps,‖ sudden action of the circulating system, as in the cold bath,¶ in the cold

* Faits pour servir à l'Histoire des Inflammations Veineuses et Arterielles, Biblioth. Médic. tome xvi. Schwilgué; Medico-Chir. Trans. vol. iii., Travers and Wilson; Clarke's Practical Essays on the Management of Pregnancy.

† Breschet, Traité des Maladies des Artères et des Veines.

‡ Ibidem.

§ Portal, Anatomie Médicale, tome iii.

‖ Hodgson on Diseases of the Arteries and Veins.

¶ Portal, Anatomie Médicale, tome iii.

state of intermittent fever,* and from blows, an instance of which I witnessed in the thigh of a man, who received a blow from a hammer, where the branches of the vein accompanying the arteria profunda femoris were ruptured. When slowly dilated, however, veins bear distention better than the arteries.

The veins are liable to be deranged in their functions from pressure, and from gravity; and those of the lower extremities, as also those returning the blood from the testicles and ovaria, seem most subject to be disturbed from such causes. When they become enlarged and tortuous, they are named varicose. The hemorrhoidal veins are also frequently varicose; likewise the superficial epigastric, and those at the bend of the arm, have been found in this state.†

Morgagni observed the jugular veins dilated,‡ and Portal the right subclavian vein dilated.§ The femoral vein immediately distad to Paupart's ligament has been found so dilated, as to be mistaken for hernia. Sometimes coagula of blood are deposited in varicose veins, and were formerly extracted by surgeons; || but this practice, from its frequently producing violent constitutional irritation, is now abandoned; and for the same reason, the tying of veins with ligature is abandoned.

Pain and inflammation of the skin and cellular membrane frequently accompany dilatation of veins, the inflammation terminating either in abscesses or indolent ulcers around the veins. When the hemorrhoidal veins

* Portal, Anatomie Médicale, tome iii.

† Petit, Traité des Maladies Chir. tome ii.; Hodgson's Treatise on the Diseases of the Arteries and Veins.

‡ Letter xviii. Art. 9, 10, 11.

§ Cours d'Anat. Med. tome iii.

|| Petit, Traité des Mal. Chir. tome ii.

are varicose, they are named hemorrhoids, or piles; and besides being varicose, they frequently rupture and effuse their blood into the cellular substance; which last state, I am disposed to think, is that in which we find them when we apply the term hemorrhoids; for in a multiplicity of instances which I have examined after death, I have invariably found those tumours around the anus, consisting of effused coagulated venous blood, in the loose cellular web of that region; while the veins of the rectum leading to these tumours, were enlarged and tortuous. In life they should be freely laid open with a lancet, and afterwards poulticed till free of pain; then anointed with the ointment of nut-galls, or bathed with the decoction of oak-bark, and lastly discussed with the rectum bougie, introduced at bed-time, and left to remain as long as possible. When touched with the lancet, if they bleed much, a piece of dry sponge, and the T bandage, or a couple of handkerchiefs applied after it, will be found to suppress it. Those of the spermatic cord in man are very frequently so affected, and begin sometimes very early in life. The female, in the advanced stages of gestation, is most subject to those of the leg; however, women unimpregnated are even affected: men are also occasionally affected with varicose veins of the legs, being consequent on collections of feces in the intestines, and tumours of the abdomen or pelvis. This varicose state sometimes arises in consequence of the circulation of the vein being obstructed, and even obliterated. In some instances, the vein ruptures, and hemorrhage takes place; an occurrence by no means uncommon in the saphena major of the leg. In the varicose state of the legs, bandaging and attention to the bowels generally dissipates them. A strong decoction of oak-bark is a powerful auxiliary. In varix of the spermatic cord, the application of oak-bark decoction is

still more indispensable, as no bandage can be applied; the whole veins of the scrotum, as also those of the spermatic cords, are occasionally affected. The suspension of the testes by a bandage, and attention to the bowels, are requisite, together with the frequent application of cold water, and lying the greater portion of the twenty-four hours in the horizontal posture.

Varicose aneurism* is that species which is produced by a lancet, or any sharp-pointed instrument, transfixing a vein, and wounding an artery in its immediate vicinity, so as to establish a communication between them, and allow the arterial blood to flow directly into the vein. Inflammation is excited at the wounded points of the vein, fascia of the biceps and the artery, so as to form a bond of adhesion between them, and a passage for the blood; for it sometimes happens, that the wound in the artery does not adhere to that of the fascia, and the blood escapes beneath the latter, and is diffused into the cellular substance, forming false aneurism. A tumour is soon formed of a bluish colour, which communicates a tremulous motion and rustling noise to the touch and hearing; and the veins in the contiguity are more or less varicose. This species of aneurism occurs most frequently at the bend of the arm, but has been known to occur between the subclavian artery and vein, the popliteal artery and vein, and the femoral artery and vein. This species is treated by compress and bandage, and if these fail to accomplish a cure, by securing the artery by operation. See Parts II. and III.

Aneurism by anastomosis, first correctly and properly described by my able preceptor, the late Mr. John Bell, is that species where the small arteries and veins are so

* Syn. Aneurismal varix.

numerously collected at any part of the body, as to present a peculiar vascular appearance. This species is first the simple nævus maternus, when the blood-vessels are generally so small, as not to prove troublesome or serious. These, however, as the individual advances in life, increase in calibre, rupture in sultry weather, or in intense cold, producing hemorrhage, which each time becomes more momentous, until at last it proves fatal. This is particularly the case when it attacks a surface delicately covered with integuments, as the lips. In one or two cases of children, I have witnessed this disease involve the chest, neck, mouth, fauces, and pharynx. This disease sometimes follows an accident. Mr. J. Bell mentions that there are intermediate cells between the arteries and veins, which may be the structure in those cases depending on accidental violence; but in those I have had an opportunity of examining, and which appeared to be consequent on congenital marks, there was no cellular intervention. The veins in some instances have been found to form the greater portion of the tumour.

Aneurism by anastomosis, when insulated, may be removed by operation, by extirpating the vessels and structure in the neighbourhood, and securing the arteries leading to it. The simple securing of the arteries leading to this vascular body, has been found ineffectual; while in the early stage of the disease, pressure and cold applications have proved efficacious.

Veins are very seldom converted into cartilage, or ossified, or covered with calcareous depositions; cases, however, are recorded by Morgagni,* Baillie,† Macartney,

* Morgagni, Letter lxiv. Art. 9.

† Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. i.

Hodgson,* Beclard, Breschet,† and other authors. Loose calculi have also been found in veins;‡ and tumours, resembling in appearance those in the contiguity, have been found growing from the lining coat of veins.§ There are several instances on record of large veins being obliterated, as the vena cava inferior, and the circulation carried on by the vena azygos.|| I met with a preparation in the dissecting-room, where no trace of the vena cava inferior was to be found, and where the vena azygos carried on the circulation. Veins, like arteries, are frequently involved in inflammation, ulceration, mortification, &c. of contiguous structures.

The chemical composition of the blood, and the theory of respiration, with the diseases of the lungs, will be given in a subsequent Part.

* Hodgson on Diseases of the Arteries and Veins.

† Breschet, Traité des Maladies des Artères et des Veines.

‡ Ibid., and Hodgson on Diseases of the Arteries and Veins.

§ Ibid.

|| Bartholinus Observat. Anat. Cent. ii. Hist. xxxv.; Haller, Opuscula Path. Obs. xx.; Transactions of a Society for the Improvement of Med. and Chir. Knowledge, vol. i. p. 127, and vol. iii. p. 70; Scarpa on Aneurism, Wishart's Translation, p. 20, note.

ERRATA.

Omitted in page 195 of Physiological and Pathological Observations, in last line, " After the seat of injury, and the compression still continued."

In page 5 of Part IX., sixth line from the bottom of the text, *read*, " thyro-hyoideus, marked Z, in Plate VIII. of Part II."

In page 23 of Part IX., fifth line from the top, *for* " the objects which it forms," *read* " the objects which form it."

NOTICE.

The Author has intentionally left out the Surgical Remarks on the Eye, as he found them so voluminous, and involving so much of the Physiology of the Eye, that he has considered it preferable to give them hereafter. The description of the viscera of the thorax and abdomen will be given in Part XI., as the plates in Part X. do not embrace the whole of these organs.